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CHEMICAL AGE

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ATOMS FOR PEACE

THE largest technical conference ever to be held in the world is the Second International Conference on the Peaceful Uses of Atomic Energy at Geneva, which began on 1 September and will end on 13 September. Some 5,000 scientists and observers from about 80 countries have met to pool the latest knowledge on nuclear research, etc. About 2,000 are official delegates from 66 governments and nine United Nation Agencies, and an estimated 3,000 are observers from organisations, commercial companies and academic institutions.

Over 2,200 scientific papers have been submitted to the conference by specialists from 46 governments and six intergovernmental organisations. Of these papers, about 250 will be presented orally. This is more than double the number submitted to the first conference held three years ago. The conference proceedings will be published in 33 volumes as against the 16 volumes required for the 1955 conference. Publication is expected to be completed by June 1959.

At the same time 20 governments have set up scientific exhibits in a special building in the grounds of the Palais de Nations. Displays include experimental thermonuclear devices, operating fission reactors, models of nuclear power plants, demonstrations of the use of radioactive isotopes in industry, agriculture and medicine, safety precautions in atomic plants and the latest experiments with high-energy particle accelerators used in atomic research. Fifty films have been provided by seven governments and will cover similar subjects.

During the general sessions, a vareity of subjects is being considered ranging over experiences with nuclear power plants, health and safety, progress in the use of isotopes, nuclear energy for purposes other than generation of electricity, recent developments in fundamental physics, training of technical personnel, etc. In the technical sections, physics; reactors; chemistry, including the separation of isotopes, processing of reactor fuels, and the treatment of radioactive wastes; isotopes and biology; and new methods in metallurgy and reactor technology will be considered.

A new subject this year to the conference is that dealing with the possibilities of producing usable electric power through controlled fusion. Almost 100 papers will deal with fusion experiments or studies. Much information is being released by the UK on the specific experimental apparatus Zeta. The US and USSR are also describing their work and devices in this field.

Experiences with nuclear fission reactors can now be reported and reviewed since several industrialised firms have such reactors producing power. In the more chemical aspects of this field many papers have been submitted which consider problems in producing and processing fuel for fission reactors, including separation of uranium isotopes and the reprocessing of used fuel elements.

Hundreds of papers describe the use of radioisotopes in industry, basic sciences and medicine, particularly as a source of radiation or as 'tracers'. It is of interest to note, however, that although comparatively few countries today are using atomic energy as a source of power, countries in every part of the world are employing radioisotopes in speeding up industrial tasks, in diagnosing and treating diseases, in initiating or tracking chemical reactions.

As a means of putting the maximum amount of information before the conference in the minimum time, a number of 'survey papers' are included which summarise the ground covered by many other individual papers

At the start of the conference, both the UK Atomic Energy Authority and the US Atomic Energy Commission announced that they were declassifying information relating to experiments in the peaceful application of thermo-nuclear power. Details were also announced by Russia, France, the US and the UK regarding new types of reactor furnace designs. The US is also expected to give details of a new and very cheap method of processing uranium.

The decision to declassify will make it possible for research workers in atomic energy authorities to talk freely about their work to opposite numbers in other countries and to colleagues in universities. It will also assist those scientists from countries without experimental nuclear machinery to contribute more easily to present research.

As a result of the conference and the exhibition, the UK hopes to obtain orders over the next four or five years for more than £400 million worth of atomic energy equipment. The exhibition clearly shows that since the 1955 conference atomic energy of the fissile kind is indeed the basis of an industry, and in this industry, the UK is in the dominant position. Constructors John Brown Ltd., for instance, have undoubtedly scored a great success in designing a plant for production of heavy water by a process of ammonia exchange. (See Distillates last week and p. 397 this issue.) The claims that heavy water can be produced at a cost of $21.5 (£7 14s.) per lb. compared with the US list price of $28 (£10) per lb. up till now the lowest price in the world are indeed significant of the present UK trend in the atomic field.

Much useful information will be gained from the various papers on metallurgical developments. While the new alloys such as those of beryllium are of immediate importance in the atomic field, these will eventually find other uses, especially, it is considered, in the aircraft industry. To this end it is of interest to note that Imperial Chemical Industries Ltd., Britain's leading chemical concern, have within the last few days announced their intention of building Europe's first full-scale beryllium plant.

Similarly three leading companies in the nuclear and chemical engineering fields—Power-Gas Corporation, John Thompson and Humphreys and Glasgow (sece p. 397) have now formed a new company, Nuclear Chemical Plant Ltd. The resources of these companies with their experience in meeting requirements of the nuclear energy industry will thus be available to the new company in the rapidly expanding field of nuclear process and treatment plants. To the forefront will be the needs of the export market regarding reprocessing of irradiated fuel.

Such is the scope of this Geneva conference and exhibition, that it must have a world-wide impact as well as a great influence on atomic science generally. Besides the announcements of new developments, new discoveries in physical, chemical and metallurgical fields, it should indicate the present knowledge of radiation hazards, the dangers and ways and means of overcoming these. This is a vital point at the present time. With growth of nuclear power stations, increasing use of radioactive-isotopes, etc., the treatment of radioactive effluents from power stations and all laboratories using radioactive materials, must be carefully considered and precautions taken. Otherwise the most significant advance in the history of science—the discovery of nuclear fission and the transuranic elements—will lead to the end of man's world.

U.S. ANTIBIOTIC INDUSTRY

SIX large producers of antibiotics, Charles Pfizer, American Cyanamid, Bristol-Myers, Bristol Laboratories, Olin Mathieson and Upjohn have made the news headlines in the US with the Federal Trade Commission's release of an economic report on US antibiotic industry and the commission's antitrust charges. These latter allege attempts at monopoly of tetracycline and its derivatives to conspiracy to obtain fraudulent patents on these products. (*Chem. and Engng. News*, 1958, **36**, No. 32, p. 27).

Pfizer's are charged with making false and misleading statements to the US Patent Office to obtain a key patent (US Pat. No. 2,699,054, granted in January 1955). American Cyanamid, Pfizer, and the two Bristol companies are charged with withholding 'material and probative' information from the patent office in connection with the tetracycline patent and all the five companies are charged with soliciting and accepting licences from Pfizer to make and sell the antibiotic.

The six antibiotic manufacturers deny the FTC charges. Commenting on price policies, American Cyanamid president has said that pharmaceuticals, including antibiotics, have been almost the only commodities to resist recent upward price trends. Intense competition in the industry has meant heavy research expenditure and this has had to be supported by money obtained from the successful products. Bristol-Myers say that antibiotic selling prices are fair and reasonable, having regard to high capital investment, heavy research costs and rapid obsolescence of existing products.

The reason put forward by the FTC for the fraudulent patent change, is that Pfizer failed to reveal that the antibiotic had been known and was in use before the alleged invention; that is, the antibiotic was on sale for more than a year prior to filing the patent application. In fact, FTC have evidence that a patent examiner of an earlier application rejected a tetracycline patent by a Pfizer employee. Reason for the rejection in this instance was that the nature of the product had already been disclosed in previously granted patents on terramycin and aureomycin.

These FTC charges are disturbing, particularly to the Subcommittee on Patents, Copywrights and Trademarks. The committee's chairman has stated that if it is true that Pfizer obtained the tetracycline patent through fraudulent representations to the Patent Office, no FTC order can provide an adequate remedy. In fact he urges FTC to ask the Justice Department to file suit to revoke the patents.

Results of the FTC's study on antibiotic price policy, patents, profits and concentration has been released as an economic report. It shows that in 1948 penicillins accounted for 65 per cent of total production; in 1956 this had fallen to 34 per cent. By this latter date, however, the new broad spectrum antibiotics—aureomycin, terramycin, chloromycetin and tetracycline, had obtained 39 per cent of the market. A particular feature noted is that while the price of penicillins and streptomycins decreased 69 per cent over the period 1948 to 1951, published prices of the broad-spectrum antibiotics have remained unchanged and more recently introduced antibiotics have been offered at the same price level.

A trend to concentration of production in the hands of fewer companies is shown. Half the total antibiotics production came from two companies; four companies produced 82 per cent of penicillin and the survey indicates that 17 of the 29 antibiotics produced in 1956 were made by a single company. Antibiotics producers have concentrated their research efforts on the discovery of patentable antibiotics, to insulate themselves from agressive price competition. Production of recently patented products has been confined, the survey shows, to one or a few companies.

The matter does not rest here for the survey points out that some patents have been handled in a way that may violate the antitrust laws. Restraint of trade aspects are also suggested.

UK Chemical Engineers Launch Export Drive in Nuclear Processing

Overseas Governments Offered Plant for Uranium and D_2O Extraction: ICI to Pioneer Beryllium Production

COINCIDENT with the opening of the Atoms for Peace exhibition at Geneva on 1 September, comprehensive plans were announced by British chemical engineers for meeting the world-wide demand for nuclear energy equipment.

● Three leading British chemical engineering firms—John Thompson Ltd., the Power-Gas Corporation, and Humphreys and Glasgow Ltd.—have formed a joint company, Nuclear Chemical Plant Ltd., to design and engineer processing and treatment plant for the nuclear industry overseas.

● The Metals Division of ICI are to build Europe's first plant for the production of wrought beryllium.

● Constructors John Brown Ltd. have developed a new method of producing heavy water from ammonia synthesis gas by ammonia exchange at a price well below that charged by the US Government monopoly.

Further announcements are expected shortly concerning another consortium in the nuclear fuel processing and recovery field, an alternative packaged plant for heavy water production, and a second beryllium production unit.

These striking developments are a direct result of the UK Atomic Energy Authority's policy of encouraging British chemical engineering firms to enter the nuclear field in all its aspects, by the placing among them of important design and development contracts and by the training of industrial executives in the Authority's research centres.

Consortium Formed To Export Uranium Processing Equipment

THE new joint company Nuclear Chemical Plant Ltd., is backed by three firms already widely experienced in nuclear energy engineering, and their resources of personnel and technical know-how are to be pooled for an export drive.

The company is to specialise in supplying to overseas Government-controlled nuclear energy authorities plants for processing uranium ores and recovering spent fuels. An indication of the scope of this side of the industry was given by Sir John Cockcroft last May at the Brussels conference when he quoted a possible export price of Calder Hall type fuel elements of £20,000 a ton. Spent fuel, he estimated, was worth a repurchase price of £5,000 per metric ton.

All the technical advances that have gone into the UK AEA's extensive new plant at Windscale for the conversion of uranium ore into metallic and ceramic fuel elements will be available to the new company, whose three constituent firms are already widely experienced in nuclear engneering. Humphreys and Glasgow Ltd., founded in 1951 to bring the carburetted water gas process from the US and who are building the pioneer underground gasification plant for the National Coal Board at Westfield, Fife, have the rights for all countries outside America of the 'tennis court' atomic power plant designed by Alco Products Inc., New York. Power-Gas and John Thompson have also undertaken much design and construction work for the UK AEA. Top technicians of all three companies have received training in the Authority's Industrial Group.

Heavy Water From Ammonia Will Break US Monopoly

THE news that Constructors John Brown Ltd. have completed the first stage of development work on a method of extracting heavy water from ammonia synthesis gas promises a break in the US monopoly that has held back many overseas nuclear programmes (see CHEMICAL AGE, 30 August 1958, p. 342).

CJB state that although the method has been known in broad principle for some time, a new route has been found that should bring the production cost of D_2O well below the price asked by the US Atomic Energy Commission. A pilot plant is being built at Leatherhead, Surrey, and is scheduled for completion in March 1959.

The American method has been to extract D_2O from ordinary water and by large scale production an export price of about $28 (£10) per lb. has been stabilised. But an onerous condition of sale has been that US technicians should have access to buyers' premises.

Now nuclear energy authorities all over the world are offered a packaged plant, costing £2½ million or more, capable of producing ample domestic supplies of heavy water when operated as ancillary to the production of synthetic ammonia for fertiliser and other purposes.

Deuterium From Any Hydrogen Mixture

The new method is based on a combination of ammonia exchange and ammonia distillation, and deuterium may be extracted from any mixture of hydrogen provided that the gas is dry and free from acid constituents.

The CJB heavy water plant uses only standard equipment and components of known reliability—heat exchangers, refrigeration plant, compressors, scrubbing and recovery towers and separators. As anhydrous ammonia presents no corrosion problems, the CJB plant is capable of continuous operation for periods of two or three years with routine maintenance. The process can also produce ammonia enriched threefold in N^{15}, so reducing proportionate costs, for there is an increasing demand for this isotope.

A typical plant to extract 3.5 kg. (7.7 lb.) of D_2O per hour, which in an 8,000-hour year would yield 28 metric tonnes of heavy water per annum, would occupy a rectangular site area about 300 ft. by 200 ft. Input would be 20 metric tonnes per hour of ammonia synthesis gas containing 75 per cent hydrogen at synthesis pressure. This gas is scrubbed in the recovery tower and returned for ammonia synthesis with about 5 atmospheres pressure drop.

Thirty tonnes of liquid ammonia is required for the initial charge, and approximately 50 kg. (110 lb.) for make-up purposes, but this ammonia will be carried back to synthesis in the synthesis gas which will be saturated at −40°C. An initial charge of 300 kg. (660 lb.) of potassium metal is also needed, with make-up requirements amounting to about 1 tonne per annum.

Steam consumption is 35 tonnes per hour at 600 p.s.i.a. and 900°F in pass-out turbines exhausting 27,000 kg. (59,400 lb.) per hour at 35 p.s.i.a. to the process

steam mains; but 8,000 kg. (17,600 lb.) per hour of condensate is available for return to the factory boiler system. Cooling water requirement is 800 m³ (28,250 ft.³) per hour, and the electrical load is 480 kW.

It is claimed that such a plant would be adequately staffed by 16 men working on a four-shift system (four men per shift) together with eight day labourers, all under the control of a plant superintendent. One chemist is thought to be sufficient for routine laboratory work such as the daily analysis of samples from various parts of the plant.

All-in production cost of heavy water produced by the CJB process would depend largely on the cost of capital and on the rate at which it is desired to amortise it. The company gives as a rough guide a capital outlay of £80,000 per tonne of heavy water production per annum. Operating costs will depend largely on power and steam costs, but £4 to £5 per kg. would be reasonable.

On this basis, in representative European conditions, assuming interest on capital and depreciation at 15 per cent and £5 per kg. for operation, the cost of the heavy water produced should be about £17 per kg. (£7 14s. per lb.), or $21.50 per lb.

Europe's First Beryllium Plant Planned By ICI Metals

THE Metals Division of Imperial Chemical Industries Ltd., is to build Europe's first plant for the production of wrought beryllium. Output of rod, tube, plate and finished machined parts under contract for the UKAEA is expected to begin towards the end of 1959. Any spare production capacity may ultimately be available to the aircraft and other industries.

In the first instance, the beryllium is required for canning nuclear fuel in the advanced gas-cooled reactor now being planned by the UK AEA Industrial Group, where fuel element surface temperatures as high as 600°C will be met. The use of the metal was discussed at the Manchester symposium on newer metals last October by Mr. L. R. Williams, of the research and development branch of the UK AEA Industrial Group. (See CHEMICAL AGE, 12 October 1957, p. 591.) Hitherto, magnesium has been used in British reactors operating at temperatures up to 470°C.

Melting point of beryllium is 1,280°C. The metal has a density little more than half that of aluminium and a stiffness four times as great. The strength/weight ratio is high with good corrosion resistance to carbon dioxide at elevated temperatures. In addition, beryllium has by far the lowest neutron absorption cross-section of any of the possible construction metals.

The handling and fabrication of beryllium involve specialised techniques to overcome difficulties arising from its particular metallurgical characteristics and from the toxic propertes of the metal in certain forms and compounds.

The metal is received as flakes or small beads and melted under vacuum in induction furnaces to produce an ingot. The cast ingot, however, cannot be rolled or extruded directly owing to its large grain size and poor workability; so it is powdered and sintered *in vacuo* into the various shapes required for processing by conventional plant.

Allen & Hanburys To Set Up £1 m. Pharmaceuticals Factory In Iran

A CONTRACT has been won by Allen and Hanburys to set up in Iran a £1 million factory to produce pharmaceutical products. The factory, measuring 180,000 sq. ft., will be sited 15 kilometres from Teheran. (See p. 410 for picture of the contract signing).

The contract was placed by the Imperial Welfare (Darou Pakhsh) Organisation, which provides the various welfare societies of Iran with free medical requisites for the underprivileged, under the direct guidance of the Shahinshah. This development is part of the Shah's efforts to improve welfare facilities and to establish a pharmaceutical industry in his country.

Production is planned of a wide range of injection solutions, tablets, intravenous solutions, ointments, and other essential medical products, and until the factory is completed these products are to be imported.

Terms of the contract specify that Darou Pahhsh will provide the total amount of capital involved. Allen and Hanburys will provide design and layout for the plant, and executive technical experts from their UK plants to run the factory. A further condition of the contract is that Allen and Hanburys will set up a training scheme for Iranian students at their UK factory.

An essential part of the contract is that Allen and Hanburys are to have full technical control and the responsibility to maintain their normal high standards of production.

The Iran factory is designed to become self-supporting and to produce economically, for while much of the output will be supplied by Darou Pakhsh to the various Imperial welfare organisations for distribution free of charge, a large part of the total production will be sold on the open markets within Iran.

The agreement is to run for a minimum period of 15 years with the possibility of an extension of another 10 years. Allen and Hanburys will receive royalties on the total production of the factory.

US Work on Ignition of Titanium Metal

DISCOVERY that a titanium valve, operating in an aqueous solution containing oxygen, was partially destroyed during normal operations led to an investigation by Stamford Research Institute, US, at the request of Oak Ridge National Laboratory.

During these investigations SRI have found that under static conditions titanium will ignite spontaneously when it is in pure oxygen and at pressures of 350 p.s.i. or more—but only if fresh surface is created in some way, such as breaking a tensile specimen. When the oxygen is diluted with helium or other gaseous diluent (even steam), the total pressure required rises as the oxygen level decreases, until at 35 per cent O_2, or less, the reaction no longer occurs.

Under conditions such as breaking a rupture disc, the same reaction occurs but at lower oxygen levels. Titanium will ignite, in fact, if pure oxygen is moving past the metal, when total pressure is as low as 50 p.s.i. Oxygen limiting level is about 35 per cent O_2.

Once the reactions are started, they will propagate in atmospheres with much lower O_2 levels than are required to start them.

According to SRI the burning of titanium is a very smooth reaction.

For auto ignition of titanium to occur, two conditions are necessary: energy must be released faster than it can be carried away; and oxides have to be soluble in the molten metal. Tests were made with zirconium whose oxides are soluble in the molten metal, and aluminium, magnesium, tantalum and niobium whose oxides are insoluble. Only zirconium ignited.

Import Duty On Ammonium Sulphate Under Review

THE Board of Trade are considering an application for the exemption from import duty of sulphate of ammonia (other than R grade). A statement of the applicants' case will be available to all interested parties who will undertake to treat the information as strictly confidential, and to allow their comments to be passed to the applicants for reply. Requests for a statement of the case, together with an undertaking in the terms set out above, should be addressed in writing to the Board of Trade, Tariff Division, Horse Guards Avenue, London SW1, not later than 19 September 1958.

Nottingham Chemistry Department's New Buildings

New buildings for the department of chemistry of Nottingham University are to be built by Richard Costain. The contract is valued at £870,000. The main three-storey building will enclose a courtyard containing a link block and single-storey lecture theatres with basement. The first section of the chemistry building is due to be finished in June 1960 and all building later that year.

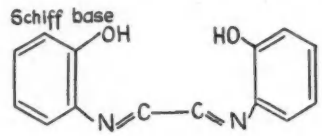
Birmingham Microchemistry Symposium-2

Feigl Demonstrates New Test for Terylene

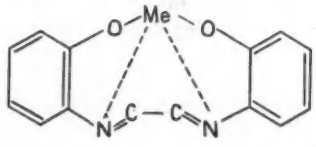
THE goal in spot test analysis must be to obtain the highest activity, specificity and sensitivity, stated Professor Fritz Feigl (Laboratorio da Produção Mineral, Ministerio da Agricultura, Rio de Janeiro, Brazil, delivering the First Plenary Lecture of the International Symposium on Microchemistry. The introduction of catalytic and microchemical reactions had proved useful and the use of solid-body reactions, and even of gaseous compounds, was interesting and valuable.

Some five years ago, Professor Feigl said, he had thought it might be useful to apply specific and selective sensitive reactions to qualitative analysis. He had therefore carried out a systematic examination of organic compounds after dry heat had been applied.

Professor Feigl said that it had been found that *o*-aminophenol (I) would condense with glyoxal (II) to give a Schiff's base which would form a complex with metals as, for example, calcium. This could be used as a test for Ca, (I) or (II).



Complex with metal formed thus



Red coloured compounds were formed with calcium.

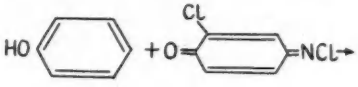
Only a few compounds had been found to form dicyanogen. Generally, hydrogen cyanide was formed. As an explanation of this finding, the professor suggested that the C—N bonding was very strong, but as water formed during reactions HCN and HCNO were obtained according to the reaction: $(CN)_2 + H_2O \rightarrow HCN + HCNO$.

Pure Pyrolysis: When organic nitrogen compounds were studied such as all compounds containing N and O, i.e. nitro, nitroso, oximes, etc., no $(CN)_2$ or HCN formed. Nitrous acid, HNO_2, was formed, however, which could be detected by the Griess reaction. Professor Feigl demonstrated this finding by dry-heating dinitrobenzol and taking up the vapour on filter paper impregnated with Griess reagent. A blue coloured spot formed. This was an excellent preliminary test for N and O.

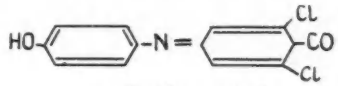
All aromatic compounds which contain

This summary of the first plenary lecture at the International Microchemistry Symposium starts the second part of our exclusive report of the proceedings, which are to be published in full by Pergamon Press. (See also last week's 'Chemical Age')

oxygen in the nucleus or side chain heated alone yielded volatile phenols. The reaction could be detected by a modified Gibb's test:



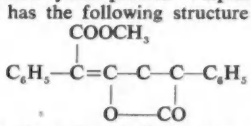
2.6-Dichloro-4-Quinone chlorimine



as condensation product.

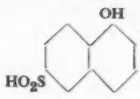
2:6-Dichloro-4-quinone chlorimine treated with ammonia gives a distinctive blue colour.

Professor Feigl illustrated that compounds having no phenol in their structure could yield phenol. Vulpinic acid which has the following structure

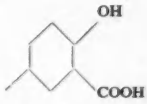


was dry-heated, and the vapour caught on paper impregnated with Gibb's reagent. The paper was then held over ammonia and the colour test denoting the presence of phenol was demonstrated.

One of his co-workers had studied more than 200 phenols, stated the professor, and had found that the para-position must be free, but if an OH group or sulphonic group was present, the Gibb's reaction was not seen.



would react but no reaction was observed with



The presence of phenol could be detected in half a minute even when very small amounts were present. The test was therefore better than physical methods; there was no need for special apparatus.

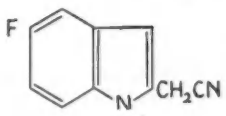
A new test for Terylene was demonstrated for the first time. It was the first specific chemical test for man-made fibres, Professor Feigl declared. Terylene fibre was dry heated and the vapour was caught on filter paper impregnated with 2:6-dichloro-4-quinone chlorimine. When held over ammonia the characteristic blue colour appeared.

Pyrolysis in the presence of inorganic partners: A new reaction for nitrogen has been developed by the professor based on the finding that all N-containing compounds ignited with MnO_2, PbO_2, etc., yield HNO_2—detected by the Griess reaction. In fact 0.2γ of nitrogen was detectable as HNO_2. This was illustrated by heating pure benzidine with MnO_2. The HNO_2 vapour was caught on Griess reagent impregnated paper, and a pinky-brown coloration developed. It was Professor Feigl's opinion that this was possibly the best micro test for nitrogen.

All H-containing compounds ignited with sulphur at 250°C are found to yield H_2S. The hydrogen sulphide was detected with lead acetate impregnated paper.

All compounds containing the groups C≡N; >C=N–; >CN=N– when ignited with sulphur yield HCNS. Detected with lead acetate paper, a yellow coloration is produced denoting C≡N.

The following indol compound



produced by a Birmingham research student, was examined by means of this test. After heating with sulphur, the lead

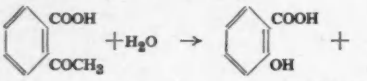
Left to right: Dr. R. Belcher, Reader in Analytical Chemistry at the University of Birmingham, Professor Fritz Feigl, head of the Microchemical Department Laboratorio da Produção Mineral, Ministerio da Agricultura, Rio de Janeiro, and Dr. W. I. Stephen, Department of Chemistry, Birmingham University

acetate paper developed a pale orange-yellow spot. Professor Feigl suggested that on heating with sulphur the dicyanogen $(CN)_2$ forms which reacts with hydrogen sulphide to give HCNS.

A $\frac{1}{4}$ mg. sample of Dynel was then identified, a dark orange-brown spot forming.

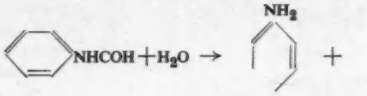
Pyrolysis in presence of water-donors —'Pyrohydrolysis': By heating organic compounds with water-donors, pyrolysis or rather 'pyrohydrolysis' was effected, stated Professor Feigl. The same effect could be obtained as with superheated water. Thus when β-naphthylamine was heated with $MnSO_4.4H_2O$, $MnSO_4$ was obtained. Some phenols could be volatilised if heated with $MnSO_4$ at 110°C. Water donors in pyrohydrolysis were oxalic acid $(2H_2O)$ at a temperature range of 101° to 170°C; $MnSO_4.4H_2O$ at 110° to 150°C (gives $3H_2O$); and $MnSO_4.H_2O$ at 150° to 200°C (forms hydrate). Succinic acid and phthalic acid lose water and form anhydrides at about 220°C.

(1) O-acetyl compounds could be heated with $MnSO_4$ or succinic acid. The vapour was caught on Congo red paper which changed to blue, e.g.:



(2) Aliphatic anilides treated with $MnSO_4.4H_2O$ at 130°C yield aniline.

Thus when formanilide is heated at 130°C with $MnSO_4$, aniline is produced and is identified with Schiff's base with p-dimethyl amino benzaldehyde.



This is considered by Professor Feigl to be an excellent test to distinguish between aliphatic and aromatic compounds.

(3) Aliphatic halogen compounds heated with succinic acid to 220°C yield halogen hydrides.

$R.Hal + H_2O \rightarrow R.OH + H.Hal.$

(4) Sulphonic acids heated with succinic acid to 220°C yield H_2SO_3.

$ArSO_3H + H_2O \rightarrow ArOH + H_2SO_4$

The sulphonic acid produced can be detected by means of ferric ferricyanide impregnated paper and a blue colour is obtained.

Professor Feigl suggested that the water of crystallisation was more reactive than water. Water freshly generated from hydrated crystals, manganese sulphate, tetrahydrate, or from elimination, as, for example, the conversion of succinic acid to succinic anhydride, was very much more active than ordinary water. This was probably due, the professor considered, to it being unassociated when freshly generated.

Polarographic Microanalysis In Reaction Kinetics

REACTION kinetics of some chemical homogeneous reactions could be followed by polarography, continuous measurements being taken directly of the reaction mixture, reported Dr. Petr Zuman (Polarographic Institute, Czechoslovak Academy of Science, Prague, Czechoslovakia) Reactions with half-times ranging from 30 seconds to two hours can be studied in this way, when the polarographically active compound is present in 5×10^{-5} to 1×10^{-3} molar solutions.

When necessary, small volumes can be used, so that using the same amount of a rare organic compound more than 1,000 times stronger concentration time-curves can be obtained than with conventional titrimetric methods.

Concentration-time curves are easily registered and evaluated. Sometimes it is even possible to measure simultaneously the change in concentration of more components in the reaction mixture. For example, in the oxidation of dihydrobenzoin by periodate the decrease in periodate concentration as well as the increase in the benzaldehyde formed can be followed.

The following examples were given by Dr. Zuman of the use of the polarograph for studying of reaction mechanisms and for the effects of substituents.

(a) Oxidation of threo- and erythro-epimers of 1,2-diols by the action of periodic acid.

(b) The alkaline decomposition of thiouronium compounds.

(c) The formation and decomposition of dithiocarbamic acid.

The reaction mechanisms were described and the *p*H dependence of the reaction rate was discussed.

Discussing the polarography and structure of organic compounds, Dr. Zuman said that the half-wave potential of organic substances as well as the dependence of their wave on *p*H of solutions could be correlated to the constitution of molecules.

The study of the influence of a substituent on the polarographic behaviour of an organic molecule might require either a qualitative or quantitative method of the expression of the relation between the substituent and polarographic data.

As examples of a qualitative expression, polar and resonance effects of substituents in an aromatic ring (benzenoid or non-benzenoid) on reduction in a side chain could be given. Substituents with + I or + 'T' effects shift the half-wave potential to the more negative values and *vice versa*. This is even true for non-benzenoid aromatics such as sydnones, where reduction occurs in the ring.

Another example that so far could be dealt with only in a qualitative manner was the effect of two identical groups on a saturated polymethylene chain. Even with hexamethylene-bis-sydnones, interaction of the xylane rings has been observed. Neither polar or resonance effects can be operative here, so the direct polar (field) effect is considered to be the most important in this case.

Bulky groups substituted on phenyl in the ortho position to a reducible group can give rise to hindrance of co-polarity and shift the half-wave potential to more negative values. Such steric hindrance of coplanetary was found in ortho-substituted 3-phenyl sydnones in agreement with the uv-spectra obtained by D. Z. Voaden.

Differences in catalytic influence of threo- and erythro-epimers were other examples of the rôle of steric conditions in polarography.

In the quantitative treatment modified Hammett's or Taft's equations enable the approximate values of half-wave potentials of some substances that have not been studied to be predicted. Furthermore, in some instances, it is possible to decide quantitatively between a polar and a steric effect or between a polar and a resonance effect.

With some knowledge of the influence of constitution on polarographic behaviour, it is possible to use the curves of compounds of partially unknown structure for evidence of the presence of a certain group or grouping in an organic molecule.

Kemula Discribes New Method of Chromato-Polarography

THE basic principles of chromato-polarography, which is a combination of chromatographic separation with continuous polarographic detection, were described by Professor W. Kemula (Polska Akademia Nauts Instytut Chemiei, Fitzrczner, Warsaw, Poland). For organic applications 'inverse' liquid chromatography was employed, and the stationary organic phase was held on a solid support such as powdered rubber or a polymer. The simultaneous separation and detection were described of a number of organic mixtures which were normally difficult to analyse. These included the isomers of nitroaniline, chlorodinitrobenzene and dichloronitrobenzene, and the homologues of the lower aliphatic nitro compounds. Certain drawbacks were outlined and a means of overcoming some of them by the use of a differential system was described. It was suggested that the technique was neither chromatography nor polarography, but was a distinct new method.

Application of the hanging drop mercury electrode, used with a conventional polarograph, to the analysis of minute concentrations of metallic ions was described. It was shown that concentrations of 10^{-8} moles/l. could be determined with ease, while in the most favourable conditions it appeared likely that as little as 10^{-10} moles/l. could be measured. The total volume required for an analyse was about one ml. Sensitivies attainable with this electrode were of the order of 10^3 to 10^5 times as great as those attained by conventional polarography, Professor Kemula stated.

Control of Purity with Oscillographic Microanalysis

OSCILLOGRAPHIC polarography with alternating current, invented by Prof. J. Heyrovsky allowed quantitative determinations of depolarisers to be carried out in the concentration range from 10^{-3} to 10^{-5} molar. For the determination of some metals in the concentration range from 10^{-5} to 10^{-9} molar a special microanalytical method had been

Professor F. J. Welcher, Indiana University, Indiana, US left, and right, Professor C. N. Reilley (Department of Chemistry), University of North Carolina, US

adapted which was based on previous accumulation of metal at a stationary mercury electrode with subsequent oscillopolarographic analysis of the amalgam thus formed. This was stated by Dr. Robert Kalvoda (Polarographic Institute of the Czechoslovak Academy of Sciences, Prague) in his paper on oscillographic microanalysis.

Metals which were deposited in the mercury pool electrode by electrolysis with constant current were at the following anodic branch of the oscillopolarographic curve $dE/dt = f/E/$ redissolved; this was accompanied by the formation of a cut-in on the oscillogram which slowly decreased. In this way it was possible to determine the metals Cu, Sn, Bi, Cd, In, Pb, Tl, Zn, Sr, Na, K or their ions. The position of the cut-in on the potential axis denoted the quality of the depolariser and the depth of its quantity.

This method used stationary mercury electrodes with various amounts of mercury: the sensitivity of the electrode increased with the decrease of the amount of mercury. This electrode was first polarised by direct current which caused the deposition of the metals at the electrode. After a certain period of time this electrode was connected by means of a switch with the circuit for polarisation with alternating current. It was at this time that the curve with the typical cut-in appeared on the screen.

For the electrolytic preparation of amalgams it was also possible to use instead of the controlled d.c., controlled direct voltage. In this case the electrode was polarised to a potential at which the deposition of the ion to be determined took place. It was therefore possible to electrolyse selectively only definite ions.

Quantitative measurements were performed by photographing the oscillograms. The maximum depth of the cut-in was registered photograpically with the exposition time of 1/25 or 1/50 sec. just at the moment of switching on the connection of the cathode from the electrolysis on to the polaroscope. The depth of the cut-in was then measured from the photographic enlargements. The results were obtained by means of a calibration curve.

From the practical applications of this method could be mentioned, for example, the control of the purity of chemicals *pro analysi*, the determination of lead in human blood, the determination of Cu and Pb in milk. Determinations of some metals in excess of the less noble ones which yielded amalgams as well could also be made.

These experiments were carried out with a cathode-ray-oscillograph (so called 'polaroscope') which was adapted for this microelectrolysis as well as for other quantitative measurements, e.g. to determine the depth of the cut-in or for comparative titrations.

Polarography in Microchemistry

By means of instrumental devices and modifications of operating procedure some authors have been able to eliminate the difficulties arising in polarographic micro-determinations, stated Professor G. Semerano (Instituto di Chimica Fisica, University of Padua, Italy). Some of these methods were briefly discussed and attention was drawn to the most recent, e.g. oscillographic polarography alternating current polarography and square wave polarography from the standpoint of microanalysis.

Some applications in the field of metallurgy, mineralogy medicine, toxicology and industrial hygiene were illustrated, Particular attention was paid to the applications to radiochemistry since polarography allowed remote analytical control and this reduced the hazards undergone by personnel engaged in this kind of research.

Symposium Members Discuss Papers In Polarographic Section

Dr. I. Bergman asked Professor Kemula whether pre-reduction of base electrolytes would provide solutions of sufficient purity for his sensitive method and whether the diffusion of metals within the hanging mercury electrode into the capillary made it necessary to polarograph the solution a short time after the deposition of the metals. Professor Kemula replied that they used pre-reduction of the solutions and pre-oxidation of the mercury as purification processes but contamination occurred after these by leaching out of the glass containers. Quartz or plastic vessels were now used.

The time between deposition and polarography by anodic stripping did not appear to be critical although they did not usually allow more than a few minutes to elapse between the two.

Dr. J. T. Sock asked Professor Kemula whether the distance between the stirrer and the hanging drop electrode was critical and what was the effect of maximum suppressors? Professor Kemula said that the distance which was $\sim$ 4-5 mm. was not critical and that no suppressors were present. He added that it was important that traces of oxygen in the solution be avoided and that great care was taken to purify the hydrogen or nitrogen which was passed through the solution.

Dr. Kalvoda told Professor Stock that the frequency of the a.c. in the oscillographic polarograph was 50 c.p.s.

Professor Stock asked Dr. Zuman whether the results he obtained were similar to those obtained at a large stirred mercury cathode and what was the purpose of the special cell which had been seen on a slide. Dr. Zuman told him that since currents vary in the early stages at a stirred mercury cathode it would not be suitable for the study of the kinetics of rapid reactions. The cell had a cellophane membrane to separate the anode compartment which contained either a saturated calomel electrode, a silver/silver chloride electrode or two electrodes which were connected to a potentiostat.

Mr. G. W. C. Milner asked Professor Kemula what accuracy would be expected in a determination of lead at a concentration of 10^{-8} M by the hanging drop technique and was told that it would be about 15-20 per cent.

Professor Bobtelsky asked whether rubeanic acid had been studied using Dr. Zuman's methods and was told that it had not although, since it was polarographically active, there was no reason why it should not be studied.

Professor Kemula reported that reaction kinetics had been studied using a combination of oscillographic and hanging drop techniques and would be described in a letter to *Nature*.

Dr. Zuman then told how polarography could be applied to a study of the structure of organic molecules in a similar manner to u.v. spectra. The resonance effect (inductive effect) and polar effect of substituent groups may be recognised and distinguished, by measurements of the half-wave potential and its variation under different solution conditions.

Professor Stock observed that to assist this work it is desirable that polarographers measure half-wave potentials with great care.

Perchloric and Sulphuric Acids for Wet Oxidation of Organic Matter

DETERMINATION of major components in essentially organic compositions (e.g. chromium in leather) almost invariably involved wet oxidation of organic matter, stated Professor G. Frederick Smith (University of Illinois, Illinois, US) in presenting the paper written jointly with Professor Harvey C. Diehl (Iowa State College, Iowa, US). The preference for wet oxidation, against the dry ashings preparational treatment, for recovery of milligram and microgram constituents resulted from the saving in time and attention required during preparation of the sample for subsequent treatment. Avoidance of dry ashing also prevent loss of the elements to be determined, due to the required 450° to 500°C temperature employed.

The first applications in the use of perchloric acid in wet ashing procedures had employed nitric acid as a preliminary oxidant. Nitric and perchloric acids had then been used as mixed oxidants. However, by effective control of reaction intensity by adjustment of acid strength and temperature applied, perchloric acid alone had been used as oxidant for destruction of organic matter. For wet oxidation of organic matter requiring the highest reaction intensity mixed perchloric and sulphuric acids could be used. Effective perchloric acid concentrations were from 70 to 100 per cent.

Perchloric Oxidations

For perchloric oxidations at definite concentration and controlled temperatures, an apparatus as originally designed by Bethge (*Anal. Chim. Acta,* 1953, **10**, 317, was recommended by Professor Smith (see Fig. 1).

A digestion flask of 125 to 500 ml. volume is surmounted by an air condenser which is surmounted also with a small water-cooled reflux condenser. A three-way stopcock provides for the return to the reaction flask of all condensate to prevent alteration in the perchloric acid concentration of the reaction medium. At a later stage of the reaction the return flow of condensate can be cut off with collection of distillate in the air condenser leading to gradual concentration of perchloric acid from 60 per cent to 72.5 per cent with accompanying steady increase in oxidation potential. Perchloric acid lubricates the stopcock during the reaction. The same digestion apparatus is used for oxidations employing mixed perchloric-sulphuric acids.

Cellulose, proteins, collagens and other products are soluble in hot perchloric acid and are readily destroyed using the correct acid concentrations. For organic materials which are essentially carbon, such as decolorising carbon or coal, mixed sulphuric and perchloric acids are required. Concentration of perchloric acid ranges from 72.5 to 100 per cent. The sulphuric acid, by its dilution effects, serves to control the reaction.

With oxidative degradation products such as oxalic and formic acid, oxidation occurs readily with no darkening of the reaction. Perchloric acid 72.5 per cent is used together with vanadium as catalyst.

The perchloric sulphuric and nitric acids can be distilled (the perchloric

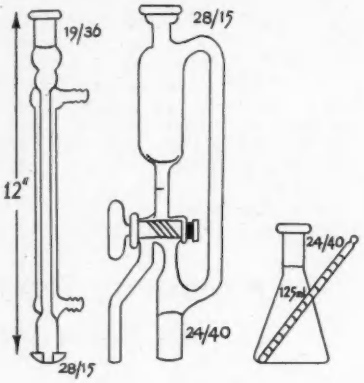


Fig. 1. Bethge apparatus

under vacuum) to ensure freedom from trace elements.

Boiling point of mixtures of 96 per cent sulphuric acid, 70 per cent perchloric acid and water for dilution ranges from 185° to just over 200°C. The effective perchloric acid concentration resulting is 67 to 72.5 per cent (see Fig. 2). For mixtures of 96.3 per cent sulphuric acid with 69.6 per cent perchloric acid giving an effective strength of perchloric acid between 70 and 100 per cent, the boiling point of the solutions range from 212° to 218°C.

Reaction rates are materially increased by the presence of 1 to 2 mg. of either vanadium or chromium with preference for vanadium (catalyst additions are made using ammonium vanadate or potassium dichromate). The oxidising acids reform pervanadio acid or chromic acid from their reduced states when all organic matter has been removed and by imparting their characteristic colour to the solution the catalysts serve as indicators for the reaction end point.

Perchloric acid does not interfere in follow-up determinations of wet ash retained metals and non-metals such as arsenic, phosphorus, iron, copper, cobalt, zinc and manganese. By simultaneous use of nitric acid, sulphur may be determined. All perchlorates of metals, and a predominant group of organic compositions, are soluble in perchloric acid (quantitative silica recovery being an exception of great value). Even hot and concentrated perchloride acid does not char many types of organic matter and oxidation is completed without troublesome formation of precipitated carbon deposition.

In a second paper, Diehl and Smith dealt with 'wet oxidation of organic matter employing mixed perchloric and sulphuric acids at controlled temperatures and graded high potentials.

It was found that carbon as cocoanut charcoal or Darco decolorising carbon could be wet ashed, employing boiling mixed sulphuric (96.3 per cent) and perchloric acid (69.6 per cent) with added vanadium catalyst. With these concentrations and equal volume mixtures, an effective perchloric acid of 100 per cent strength could be obtained. This suggested that a preliminary digestion with concentrated sulphuric acid would be of value although more time consuming. However, foam formation is avoided. This procedure has been applied to dried whole milk.

Wet Ashing of Wool

Three procedures could be used for wet ashing of wool at high oxidation potential: (1) by use of mixed nitric plus perchloric acid, with and without vanadium as catalyst; (2) by reaction with 64.5 per cent boiling perchloric acid, with vanadium as catalyst; and (3) by digestion with equal volumes of 96.3 per cent sulphuric and 69.6 per cent perchloric acid in the presence of vanadium for catalysis. This last reaction is the most rapid.

Professor Smith demonstrated this last reaction. The Bethge apparatus was charged with 1 gm. of wool yarn, 2 to 3 mg. vanadium and 15 ml. of equal parts by volume of concentrated sulphuric acid and 69.6 per cent perchloric acid. Digestion was at low heat. At 2.5 minutes the sample was in solution (dark brown) (90°C). At 3 minutes (122°C) there was brisk ebullition; at 3.5 minutes (165°C) there was foam formation. At 4 minutes (200°C) there was double the foam formation and the colour changed from brown to green. At 4.5 minutes (205°C) the foam subsided. At 5 minutes the temperature was the same and the reacting solution yellow. At 6 minutes the reaction was complete at 203°C and orange in colour from pertitanic acid, indicating complete oxidation.

For recovery of sulphur in the wet ash residue nitric acid has to be one

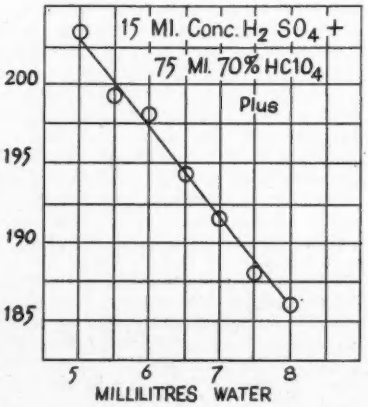


Fig. 2

Dr. R. Kalvoda (left) and Dr. P. Zuman (right) of the Cezkaslovenska Akademie ved Polarograficky Ustav, with Mr. G. W. C. Milner, UK AEA, Harwell (centre)

portion of the oxidising acid mixture. Boiling 72.5 per cent perchloric acid fails to quantitatively retain sulphur as sulphuric acid. In the absence of HNO_3, small portions are converted to sulphuryl chloride and evolved. Procedures 2 and 3 retain arsenic, phosphorus and metallic major and minor constituents, quantitatively. Following reactions 1 and 2, silica may be determined. This requires evolution of nitric acid, if involved, dilution and filtration.

Arsenic, phosphorus and molybdenum can be determined spectrophotometrically. For determination of Fe, Cu and Co chromophore group specifics were suggested by Professor Smith.

Quinoline was instanced as an example of the most oxidation stable organic materials. After a similar procedure to that described for wet ashing of wool, the wet ash residue is evaporated to remove excess acid. On cooling a white crystalline residue remains, which is soluble in water and strongly acid in reaction. Neutralised to pH 5.5 and copper sulphate added, a blue insoluble precipitate was obtained indicating the reaction product to be nicotine acid. Such an oxidation is employed in a patented procedure in the manufacture of nicotinic acid, reported Professor Smith.

Wet oxidation of synthetic fabric materials such as nylon, Dacron (Terylene) and Orlon was described. Mixed acids used were equal parts of 96.3 per cent sulphuric and 69.6 per cent perchloric acid with 1 to 2 mg. of vanadium as catalyst. All three products were exothermic to a marked degree. No carbonisation degradation products were formed. Foam formation was pronounced with nylon and Orlon. In the case of nylon and Orlon a precipitate of ammonium perchlorate formed when the solution was cool. On dilution with water all gave clear solutions except Orlon.

For analyses involving rubbers, other than the determination of sulphur, predigestion with hot concentrated sulphuric acid was recommended.

Professor Smith's Paper Discussed

Dr. W. J. Kirsten remarked that his laboratory carried out a great many oxidations at one time and quite quickly. Some 20 flasks might be used at one time. When large quantities were involved, perchloric acid was used. However, use of vanadium as a catalyst sometimes interfered with the reaction. Was there any other catalyst he could use?

Professor Smith suggested the use of dichromate as catalyst. Hydrochloric acid should be added dropwise and the catalyst was volatilised as chromyl. However, he did not think that 2 or 3 grams of vanadium should be too great a burden. Chromic acid was insoluble in 70 per cent perchloric acid and Professor Smith thought that perhaps lead vanadate might be insoluble in the same way.

Dr. Kirsten said that although phosphorus and alcohol were taken off, there was difficulty with the colour reaction.

Mr. W. J. S. Pringle (Birmingham) said he could confirm the oxidation of coal with perchloric acid but he had not used vanadium. However, he had had difficulty in the use of perchloric acid with vegetable oils, for example wheat germ oil. In his experiments an explosion had occurred each time. What precaution could he take?

Professor Smith said that the same was true of rubber as well, for the perchloric acid did not mix either with rubber or oils. The oily substance, rubber, etc., should be well digested at 300°C with sulphuric acid until it was well charred. The perchloric acid could be added to dispatch the organic matter. An air condenser should be used during the acid digestion and then when perchloric acid was added, a water condenser should be added on to the air condenser. As an example, Professor Smith said that in the US difficulty had been experienced with dried whole milk, buttermilk, cheese, etc., determinations. For instance, the Babcock test could not be applied for the determination of buttermilk in ice cream because of foreign materials present in the ice cream, such as raisins, nuts, etc. The method that he had worked out for ice cream was to digest the ice cream with equal volumes of glacial acetic acid and 70 per cent perchloric acid. The Babcock test would then be applied. The material should be heated to 100°C on a steam bath.

A delegate from Imperial Chemical Industries Ltd. said that he had also experienced difficulties with lubricating oil.

Professor Smith said that these difficulties were due to the oil floating on the surface of the acid and not mixing with it. One therefore had an interphase reaction and the flask contents would catch on fire. Again he recommended predigesting the oil with sulphuric acid and then proceeding from there.

Dr. E. Heinerth (Germany) said he had used perchloric acid in work on carboxymethylcellulose, but the reaction took three hours.

Professor Smith said that the carboxymethylcellulose should be dissolved in water and the same quantity of nitric acid. The mixture should be heated on a water bath with a reflux condenser, and perchloric acid added.

Film on Oscillographic Polarography Shown

DURING the International Symposium on Microchemistry at Birmingham, the film 'Oscillographic Polarography' received its first showing in Great Britain. It is actually the fourth part of the film on 'Polarography', which has been made in Czechoslovakia under the guidance of Professor J. Heyrovsky, the discoverer of polarography and now director of the Polarographic Institute of the Czechoslovak Academy of Sciences in Prague. The earlier parts have been extensively shown in this country under the auspices of the Polarographic Society, from which it is available for hire.

'Oscillographic Polarography' has been shown during the Universal Exhibition in Brussels, where it received a gold medal. It was introduced to the symposium by Dr. R. Kalvoda, of Prague, who was responsible for much of the scientific detail in its production. It runs for about 30 minutes and, unlike the earlier parts, is in full colour.

After a brief introduction to the history and principles of polarography, the advantages of cathode ray presentation are stated and the theory of a technique of oscillographic polarography using superimposed alternating current, is presented. The shapes of numerous characteristic waves, obtained with both the dropping mercury and streaming mercury electrodes are discussed and explained, and the operation of the apparatus is demonstrated. A number of determinations, studies of reversibility and kinetic studies are described and the definite advantages of this technique over classical polarography, for some types of work are indicated.

The British Polarographic Research Institute hopes to include Part 4 when it shows the film at the Battersea Polytechnic, on 11 September at 6.30 p.m. Visitors will be welcome.

KID Exemption Ended for Imports of Dimethylamine

The Treasury have made an Order ending the temporary exemption from Key Industry Duty of imports of dimethylamine. The Order, which came into operation on 3 September, is the Safeguarding of Industries (Exemption) (No. 5) (Amendment) Order, 1958, and is published as SI 1411/1958, price 3d net (by post 5d) from HM Stationery Office.

'Beryllium Hazards, Negligible if Sample is Small,' Chirnside

THE following is a summary of discussion on the paper presented at Birmingham by Mr. R. C. Chirnside (General Electric Co.) on the application of micro techniques in the electrical industry (see CHEMICAL AGE, 30 August, p. 352).

Mr. C. R. Curry (Mineral Resources Division, Overseas Geological Surveys, Imperial Institute Bldgs., London SW7) inquired whether in the absence of blanks, beryllium had been confirmed satisfactorily, at the extremely low level quoted (10^{-8} gm.) as compared with boron. What precautions were taken against health hazards for the analyst, for example, volatilisation of beryllium oxide in the arc by the spectroscopist?

Since in some circumstances spectroscopy was not a practical possibility, Mr. Curry asked whether Mr. Chirnside had investigated any other methods for the determination of beryllium, not necessarily at that extremely low level.

Mr. Chirnside, in reply, stated that beryllium hazards were absent or negligible if the sample was small. If the sample was large, protection of the spectroscopist was effected by good ventilation. They actually received no dangerous samples. If samples were dangerous, a glove-box method would be used.

Dr. J. W. Robinson (Baton Rouge, La., US) wished to know whether the electron microscope had been used in this work and whether the rotating disc electrode had been used rather than the porous cup method for spectrographic work. The electron microscope had been used, said Mr. Chirnside and any necessary test. The rotating disc had not been used, however.

CO_2 Analysis

Mr. C. Whalley (Laporte Chemicals Ltd., Luton, Beds), inquiring about further details of the gas chromatography method for the analysis of carbon dioxide, asked Mr. Chirnside whether it would be possible to determine very small amounts of carbon monoxide, e.g., about 1 p.p.m. in carbon dioxide. This problem was difficult by conventional methods and a gas chromatographic method would be extremely simple if it were sufficiently accurate. Carbon monoxide determinations were difficult at the low level mentioned, reported Mr. Chirnside.

Mr. F. J. Armson (G.K.N. Group Research Laboratory, Wolverhampton), asked whether quantitative analyses had been carried out on the surface layers formed on iron by carbon monoxide/carbon dioxide. Referring to this determination of boron, he inquired whether the methyl borate distillation was carried out in glass, and if so, which type of glass gave the lowest value?

Mr. Chirnside said that Fe_2O_3 might be oxygen deficient. In the case of boron determination, this distillation was difficult. Quartz glass was used and it was necessary to purify the methyl alcohol used.

Miss J. Cooper (Joseph Lucas (GFE) Ltd., Liverpool), wanted to know whether chloroform was a particularly suitable solvent to ensure accurate reproducibility in the colorimetric determination of cobalt using α-introso-β-naphthol. Mr. Chirnside said he had no reason to believe that chloroform was not a good solvent.

Mr. W. R. Nall (The Bragg Laboratory, Naval Ordinance Inspection Establishment, Sheffield 9), said that detailed analysis of the first century AD glass in connection with the supposed composition of the Portland vase was of particular interest. The Bragg Laboratory, Sheffield, had recently been engaged on this analysis and in the sample supplied, the colouring agent had been found to be cobalt and not antimony. Mr. Nall wanted to know whether the glass described was only thought to be of similar composition to the Portland vase. Analysis had been carried out on the white opalescent part, remarked Mr. Chirnside. Cobalt was available in the first century and used in cosmetics. It produced a very beautiful opal coating (like skimmed milk). Wedgwood was similar.

Mr. W. A. Mount (Metropolitan-Vickers Elec. Co. Ltd., Manchester) asked the lecturer whether he was aware of any chromatographic or electrophoretic methods for the separation and micro-estimation of iron oxides.

Mr. Chirnside said he was unaware of any such methods.

Mr. G. Bishops (Washington Singer Laboratories, The University, Exeter) reported that his findings in the application of ultra-micro methods were similar to those used by Mr. Chirnside in the analysis of oxide films in corrosion studies. In this case purely chemical methods of analysis were applied to films, of sample weight of a few micrograms. The films were isolated by vacuum sublimation of the base metal.

In some films, said Mr. Chirnside, acid treatment was used to remove base metal. GEC were interested in the other approach to the problem. It could probably be settled by X-ray diffraction.

Obituary

The death has occurred in a London hospital of CAPTAIN A. H. COWAP, who helped in the establishment of the ICI works at Billingham-on-Tees nearly 40 years ago. Captain Cowap who was 80 years old, joined Brunner Mond and Co. at the age of 13. Later he became chief engineer for Synthetic Ammonia and Nitrates, Ltd., Billingham, which had been formed to build the Billingham chemical works. Captain Cowap retired from ICI in 1945. For 30 years he was also a director of the Power Gas Corporation Ltd., and Ashmore Benson Pease and Co.

Chemical Industry and Universities Should Co-operate on Analytical Methods

A SMALL party of delegates attending the International Symposium on Microchemistry visited Albright and Wilson (Mfg) Ltd. at Oldbury. During a tour of the works the party saw the Kanigen plant, which operates a process under licence from the US (see CHEMICAL AGE, 1957, **78**, 365) for the use of sodium hypophosphite for electroless plating of metal. It was learned that the company is extending its interests in plating chemicals and metal finishing generally.

Another part of the works visited was the phosphorus-producing plant which could be described as the 'life blood' of the company. The raw materials used in this electric reduction process are Florida phosphate rock, silica chips and anthracite. The correct proportions of each are weighed by automatic weighers on to a moving conveyor belt which carries the materials to the electric furnaces. These are of the three-phase type with carbon electrodes, the movement of which controls the load on the furnace. Phosphorus vapour and carbon monoxide leave the top of the furnace and periodically slag is tapped from the base, together with the ferrophosphorus which is also produced in the reaction. Slag is normally used as road metal, but other more profitable outlets for this by-product are constantly under review.

A visit was also paid to the research department building which was opened some five years ago. This research centre is notable for its two microchemical laboratories and up-to-date equipment. It was learned that members of the department have built an automatic Karl Fischer titrimeter and have in use a modified Kirsten-Dumas apparatus. A room is devoted to infra-red spectroscopy and another to X-ray powder photography and single crystal work. In other research and development laboratories in the building much investigational work is being carried out on complex phosphates, in which physico-chemical techniques are being used rather than the classical methods of analysis.

Information on the part played by analysis in the affairs of the UK group of Albright and Wilson Ltd. was given by Mr. Alfred H. Loveless, technical director of Albright and Wilson (Mfg), at a dinner given during the evening. Some 25 per cent of the 900 or so technical staff were engaged on analytical work and some 1½ million tests on half a million samples were carried out annually. Of the staff on analytical work about 200 were employed in works laboratories (mainly on control analysis) and approximately 30 in the research and technical service departments.

Two things were now required by industry in analytical chemistry, said Mr. Loveless, i.e., quicker and more selective methods, and he suggested that there was considerable scope for co-operation between industry and universities on these matters as well as within the chemical industry itself on analytical methods.

MANY NEW INSTRUMENTS FOR MICROCHEMISTRY SHOWN IN SYMPOSIUM EXHIBITION

THIRTY-EIGHT companies took part in the trade exhibition held in the Department of Chemistry, Birmingham University, during the International Symposium on Microchemistry (20 to 27 August). Main exhibits of many of the companies exhibiting were covered in the special review of laboratory equipment published in CHEMICAL AGE last week.

Two series of spectrographic standards were displayed by the *Bureau of Analysed Samples Ltd.*, Newham Hall, Middlesbrough. A new series of eight low alloy steels in the form of 1 in. square bars has been developed to meet the requirements of both the spectrograph and quantometer, containing increments of silicon, manganese, nickel, chromium, molybdenum, vanadium and copper. The other series is of specially prepared mild steels containing residual amounts of nickel, chromium, molybdenum, copper, tungsten, cobalt, tin, vanadium, boron, aluminium and lead. This series is in the form of $\frac{1}{4}$ in. dia. rods.

In the series of manual polarographs designed by *Electrochemical Laboratories Ltd.*, 5 Highfield, Wardle Road, Sale, Manchester, there is a new model—Model C—which is similar to Model B having an external galvanometer, stand and electrode system complete. It has several refinements and is mains operated.

Hydrogen Generator

Described as a useful accessory for the polarograph is Electrochemical's hydrogen generator. It generates a steady flow of hydrogen (up to 2,500 c.c. per hour) and will deoxygenate 5 to 10 ml. in 5 to 8 minutes.

On the stand of Griffin and George Ltd., *Electronic Instruments Ltd.*, Richmond, Surrey, exhibited Model 33 Vibron electrometer, together with prototype Model 33B pH measuring unit. The Vibron electrometer is a vibrating condenser amplifier intended for measurement of small d.c. voltages and currents derived from a high resistance source. Neither generating nor absorbing any current from the component under test, it is stated that it can be used for measurements beyond the capabilities of the conventional d.c. valve amplifier. It can be adapted as a high impedance null detector for such purposes as comparison of ionisation currents or very high resistances; or for determination of glass electrode potentials against a standard potentiometer.

One example of the application of the Vibron electrometer is the development of a pH meter having a zero stability of 0.002 pH. The instrument is stated to make possible certain glass electrode pH determinations where other methods fail.

The pH measuring unit, Model C33B, used with the Vibron electrometer (Model 33B) is claimed to permit pH determinations of the highest practicable accuracy. Range is pH 3 to 10, stability is 0.002 pH for 12 hours and accuracy is to 0.002 pH. The C33B is now going into production.

Several new items were shown by *Electrothermal Engineering Ltd.*, 270 Neville Road, London E7. Recently developed in conjunction with May and Baker Ltd. for $\pm 1°$ accuracy over a temperature range of 0° to 360°C is a new melting point apparatus. Thermocord is a robust wind-on flexible heater for temperatures up to 450°C which is designed to supplement the existing range of heating tapes and armoured heaters. To meet needs of chemists requiring high temperature flexible heaters, Electrothermal also have a flexible furnace, which is a newly developed heater for temperatures up to 1,000°C for vessel and pipeline heating and for heat treatment processes, and an armoured heater for heat treatment processes where temperatures of up to 800°C are required.

A unit serving (a) ion-exchange chromatography, (b) pilot plant assessment of ion exchange, and (c) small scale production of conductivity water by mixed bed process and distilled quality water by two-column technique is the Elgastat Multiplan, produced by *Elga Products Ltd.*, Railway Place, London S.W.19. Essentially the Multiplan consists of a self-contained unit for execution of all known ion exchange and deionisation processes. It comprises two Plexiglass columns, one with interface for mixed bed regeneration *in situ*. Both columns are fitted with flow control valves and detachable filters. For mixing the anion and cation exchangers, an air pump is provided. Flow lines suitable for the many operation and regeneration cycles are included. For quality control a conductivity cell and monitor were available. Nine ion exchange resins including chromatographic grades form part of this unit and cover all major aspects of ion exchange technology.

On display by *Eureka Scientific Co. Ltd.*, 194/198 Ilford Lane, Ilford, Essex, was the Eureka semi-micro unit for inorganic analysis. This consists of a pear-shaped 30 ml. flask, a 9 ml. graduated receiver with side arm, a 'cold finger' condenser, a jacket for above with side arm and a twin-necked adapter all of resistance glass. Price complete with corks and rubber tubing is £1 5s. the set or £3 3s. the set if fitted with standard ground glass joints. For use with this unit is a small electric centrifuge and a compact gas generator designed to produce small quantities of H_2S, CO_2 or H_2 at high pressure.

The Eureka centrifuge has a body of spun aluminium, with hinged lid, and is finished in grey vitreous enamel. The motor is universal and suitable for use on a.c. or d.c. currents and is fitted with a cast gunmetal head with two removable spun aluminium buckets to take standard Pyrex test tubes 75 mm. by 10 mm. Price is £9 10s.

The Holness gas generator is automatic in operation, is compact and portable and gas pressures greater than 30 in. of water can be obtained. All parts are replaceable. Price of the complete apparatus is 40s.

The Walsh atomic absorption attachment for the Uvispek was shown by *Hilger and Watts Ltd.*, 98 St. Pancras Way, London NW1. Atomic absorption spectrometry is a method of overcoming inter-elemental effects such as lead in leaded brasses which interferes

Soviet scientists at the exhibition stand of Hudes Merchandising Corporation Ltd., 52 Gloucester Place, London, are seen inspecting a Selecta rapid balance, made by Sartorius-Werke, West Germany. L. to r. H. A. Kamm and N. G. Mills (Hudes); Professor M. Lomonosov (Moscow University); M. Bourtsev (interpreter); Professor Jukhovilsky (Institute of Steel); Professor R. P. Lastovsky (Institute of Pure Chemical Reagents); and W. T. Elwell, hon. secretary of the executive committee

Left to right: Mr. S. Greenfield, Mr. M. Attwood and Mr. M. Clift of analytical research department, Albright and Wilson (Mfg.) Ltd.

with the copper in spectrochemical analysis. It is claimed to have few limitations: the rate of flow of the solution has to be very accurately controlled and a separate lamp is needed for each element to be determined.

Hudes Merchandising Corporation Ltd., 52 Gloucester Place, London W1, exhibited on behalf of *Paul Bunge*, Hamburg 23, Germany, and *Sartorius Werke AG*, Gottingen.

Paul Bunge have a mocrochemical air-damped balance, model 25 DKL. This has a capacity of 30 gm., and a sensitivity of 0.0001 mg. which equals 0.1 division on the microscale. It is in an aluminium hexagonal case with two oblique sliding side windows, and has an aluminium base plate. Zero point is at left side of the rider scale. The rider is 5 mg. Zero adjustments are made from outside the case and there is mechanical application of fractional weights from 10 mg. to 990 mg. by right-hand dials. Price including one set of three shock absorbers, one set of weights (1 gm. to 20 gm.) and one transformer, is £277 10s.

Exhibits from Sartorius-Werke included the fast accurate riderless micro balance, the MPR5. Capacity is 30 gm. Range is 0 to 1 mg. in divisions of 0.01 mg. (0.001 by vernier).

Membrane filters and ultra filtration apparatus from Membranfiltergesellschaft of Sartorius-Werke AG were also displayed. The membrane filters are manufactured from a cellulose ester while ultra fine filters are produced from regenerated cellulose. They may be used for the study of disperse systems in organic solvents. Both types of filter are available in a range of porosities between 1,000 and 5 millimicrons and sizes up to 300 mm. (12 in.) in diameter. They are suitable for use in the study of lyophilic and lyophobic colloids. Refractive index is 1.5, pure volume is 50 to 85 per cent. They are resistant to one hour's immersion in 20 per cent H_2SO_4, 20 per cent HNO_3 or 20 per cent HCl, 1 per cent NaOH or KOH and 8 per cent NH_4OH.

Jencons (Scientific) Ltd., Mark Road, Hemel Hempstead, Herts, had on display items and apparatus of specialised manufacture for both microchemical and chemical fields. New to this company's range were silica ball and socket joints to BSS microscopes and accessories and the new 12 in. desiccator.

Micro combustion furnaces manufactured by *McMurray Industries*, 48 Denver Road, Dartford, Kent, were exhibited. A semi-automatic furnace for the rapid methods of Dr. R. Belcher and G. Ingram was shown, and also a semi-automatic assembly for direct determination of oxygen by the F. Oliver modification of the method developed by I. J. Orta and H. S. Conway.

Many new design features are contained in the new Optica CF4 double-beam ratio-recording grading spectrophotometer produced by *Optica United Kingdom Ltd.* and *Joyce, Loebl and Co. Ltd.*, A7 Princes Way, Team Valley, Gateshead-on-Tyne 11. Resolution is stated to be extremely high so that it is possible to work at 1,900Å, with a nitrogen purge, with a bandwidth of 1-2Å.

Of the wide range of accessories, a new ultra-micro flame attachment, using an integrating principle, extends the flame method by a factor of 1,000, while the Ulbrich sphere attachment offers a new tool for colour control in dye and paint factories, etc.

Latest version of the Joyce double-beam automatic recording micro densitometer, Mark III, has a density range of 0-3 or 1-4, its resolution is stated to be better than 1 micron, and its optimum writing speed is 40 cm./second. A novel design feature is the proportional drive, which pulls the specimen across the slit at a rate proportional to the rate of rise in density. Sample and record tables are coupled, so that complete synchronisation can be obtained, ratios of 1:1 up to 1,000:1 being possible.

The Joyce double-beam recording and integrating reflectance densitometer, with its automatic integrator, which writes, by means of a second pen, the integral curve in a simple code, is now in use for spot test methods of analysis.

Specimens of Analoid compressed reagents were exhibited by *Ridsdale and Co. Ltd.*, Newham Hall, Middlesbrough. These reagents are specially prepared for the Analoid system of analysis, and it is claimed that they can be used to advantage in many methods for metallurgical analysis including those published by the British Standards Institution. Shown for the first time were Analoid preparations specially prepared for the fluorimetric determination of uranium and indicator tablets for use with solutions of EDTA.

Now in use in a number of research establishments and hospitals where water of the highest purity is essential is the Scorah Automatic Electric All-glass Water Still. It is obtainable from *L. V. D. Scorah*, 44 Northfield Road, Kings Norton, Birmingham 30. The still is automatic in that it can be left on without attention. Heater current cuts off if the water supply is interrupted, or inadequate or forgotten. When the receiver is full (5 l. capacity) the current cuts off. When distilled water is drawn from the receiver the still resumes operation until the receiver is refilled. The receiver vessel ensures absence of contamination by the laboratory atmosphere from which electrostatically charged condenser droplets can otherwise pick up fumes, dust and air-borne micro-organisms. The heater, of Scorah design and manufacture, has a consumption of 1,700 watts, and the still output is 2.4 l. per hour (the full theoretical yield). Cost is 3½d. per gall. at 1d. per unit. The heating element is out of contact with the feed water thus eliminating danger from 'live' water supply or electrolytic effects or 'burn out'. On the heating surface of the boiler vessel is a new development which is a special nuclei-forming glass coating that promotes smooth, easy boiling free from 'bumping'.

No retort stands or clamps are required for assembling the still. The 2½ in. diameter ball joint gives a strainless set-up. There is an outlet cap on the boiler for quick periodical drain-off of sediment. The still may be installed on a shelf or platform about 1 foot above bench level, near a sink and enclosed in transparent plastic cover to keep out dust.

Price complete with heater and all electrical equipment 230 volts (a.c. only) is £25 10s. inclusive of carriage and packing in UK.

Microcell Attachment

Prototype of a new microcell attachment, SP680, was shown by *Unicam Instruments Ltd.*, Arbury Works, Cambridge. This new accessory makes available similar facilities for microcell work with the SP600 Spectrophotometer as the SP58.0 microcell attachment provides for the ultra-violet instrument. The attachment takes the form of a self-contained unit which replaces the standard cell holder and accepts microcells of 10 and 20 mm. path length. The capacity of the smaller of these cells is approximately 0.45 ml.

The attachment provides a useful addition to the instrumentation available for microchemistry, and further extends the range of applications of the Unicam Spectrophotometer SP680.

FAC universal construction kit was displayed by *Weyco (Sales) Ltd.*, 18-20 Dames Road, London E7, the sole agents for Mark Sylwan Aktiebolag, Hornsgaten 89, Stockholm, Sweden. This kit contains selected standard elements which are easily assembled into a variety of working models for experimental and demonstration purposes. Frameworks and carrying structures can be built within a wide range of sizes and are capable of supporting very heavy loads. Components of a model can be placed at any specified point in the framework for precision work.

BA CHEMISTRY SECTION DINNER

At the Chemistry Section dinner held during the annual meeting of the British Association, l. to r. TOP LEFT: B. N. Frasad, general secretary, Indian Science Congress, Dr. J. M. Harvey, senior lecturer, Royal College of Science and Dr. M. Ahmed, Pakistan Association for Advancement of Science; TOP RIGHT: Dr. James Craik, chairman, ICI Nobel Division, Sir Alexander Fleck, ICI chairman and BA president, Dr. D. C. Martin, assistant secretary, Royal Society and recorder of the Chemistry Section; BOTTOM LEFT: Sir David Anderson, Governor, Royal College of Science and Technology, Lady Anderson and Professor H. J. Emeleus of Cambridge, president of the Chemistry Section; BOTTOM RIGHT: Mrs. Raphael, Professor R. A. Raphael, Professor of Chemistry, Glasgow University, Professor P. D. Ritchie, Professor of Technical Chemistry, Royal College of Science and Technology, and Mrs. Ritchie

New Work on Bakelite Epoxide Resins Published

NEW developments connected with Bakelite epoxide resins are the subject of three advance information sheets, E.23, E.28 and E.29, which give the first published information on new developments connected with Bakelite epoxide resins. E.23 describes how in the manufacture of press tools, foundry patterns, jigs and moulds from Bakelite epoxide resins, a method widely used is that in which a non-draining thixotropic facing coat of filled resin is applied to the pattern, allowed to body, and backed by a casting or laminate.

To simplify the process and reduce the amount of handling involved by users, Bakelite Limited are now marketing DR.19114 which is a premix of epoxide resin, slate dust filler and Aerosil thixotropic agent.

E.28 gives information on work of the Bakelite laboratories which has resulted in the development of a new reactive flexibiliser DQ 19116. This is a modified amine designed to obviate handling difficulties.

E.29 gives details of a new hardener, DQ 19117 introduced for use with R 18774/1 resin. The combination of resin and hardener gives a cold setting system.

Copies of all three sheets are available from Bakelite Ltd., 12-18 Grosvenor Gardens, London SW1.

Chemistry's Massive Contribution to British Industry

REFERENCE was made to the massive contribution chemistry and chemical technology had made to industry, in the toast to the Chemistry Section (Section B of the British Association for the Advancement of Science) by Sir Andrew McCance, F.R.S., at the Chemistry Section's dinner in the Assembly Hall, Royal College of Science and Technology, Glasgow, on 29 August.

Replying, the section president, Professor H. J. Emeleus, F.R.S., Professor of Inorganic Chemistry, Cambridge, made a plea for a higher status and better remuneration for science masters and teachers. These were the people, he maintained, who could create in the students science enthusiasts.

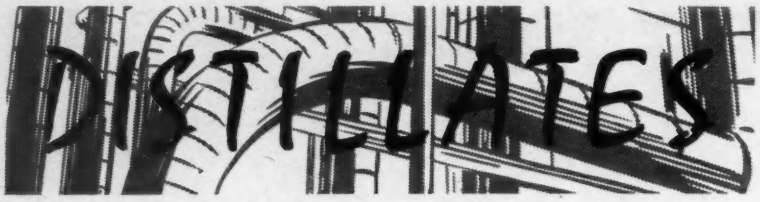
The toast to the guests was given by Professor R. A. Raphael, Professor of Chemistry, Glasgow University, and the reply was made by Colonel W. I. French, president of the Glasgow Chamber of Commerce.

Sir Alexander Fleck, F.R.S., president of the British Association, said that he wanted to add a few words to say how they all enjoyed these functions. He had attended the first meeting of the section which had been held in a rather grubby restaurant in Dundee in 1912 in conditions of extreme poverty. This was in vivid contrast to the surroundings and conditions in which they were holding their present dinner.

Dr. A. Kent, Chemistry Department, Glasgow University, (left) with Dr. J. McLean, Chemistry Department, Royal College of Science and Technology

Lifting and Carrying

First of a new series of booklets published by the Ministry of Labour on industrial safety, health and welfare subjects is entitled 'Lifting and Carrying' (HM Stationery Office, price 1s), and is aimed at the reduction of some 50,000 accidents a year caused in the handling and the carriage of goods.



★ SOVIET scientists have a habit of making 'surprise' visits to symposia in this country—remember the party of 34 who turned up unexpectedly at the Nottingham High Polymer conference (Distillates, 2 August, p. 188.) The International Microchemistry Symposium at Birmingham was no excepion. A delegation of four arrived unexpectedly at Birmingham University on 21 August. On this occasion I gather that their acceptance of membership applications had gone astray.

When asked for their impressions of the symposium and the exhibition, Professor Motorny Lomonosov of Moscow University said 'Judging from the scientific literature it is what we expected. What we have seen is of a very high standard and very modern'. Professor R. P. Lastovsky, director of the Moscow Institute of Pure Chemical Reagents commented 'We appreciate the high standard of the symposium and the quality of the exhibition'.

Our picture, in p. 405, shows the Russians at the exhibition where they spent some time on the stand of Hudes Merchandising Corporation, instrument importers, discussing a Selecta rapid balance which had been dismantled for inspection.

★ BRITISH industry has been given the chance of ensuring that the UK is represented by a gift in the new UNESCO building now being completed in Paris as a permanent headquarters. The Treasury turned down the idea that the Government should provide a gift room at the new building and a group of British businessmen have now stepped in to form a UNESCO gift committee to carry out the scheme through private enterprise.

It is planned to raise £2,500 to furnish and decorate a suite of three rooms for the chairman of the UNESCO executive board and his staff. Designer Robin Day is giving his services without fee. A plaque is to be placed on the wall of the chairman's room with the names of the donors.

The support of the Federation of British Industry has been promised. Firms represented on the gift committee include Dunlop Rubber and Permoglaze. Contributions should be sent to UNESCO Gift Committee, care of British Furniture Manufacturers' Federated Associations, 17 Berners Street, London W1.

★ FOREIGN chemical companies' distributing and manufacturing arrangements in this country can be quite complicated. Recently CHEMICAL AGE (2 August, p. 202) said that an odourless bleach, Oxone, was available from E.I. du Pont de Nemours and Co. at Bush House, London. I learn from du Pont, however, that the European office of E.I. du Pont de Nemours at Bush House is not engaged in any commercial activity for or behalf of the du Pont Co. in the US.

The Du Pont Co. (United Kingdom) Ltd., of 5 Charles II Street, London SW1, is an English company which handles the sales of a number of products of the du Pont Co. in the US, including those made by the textile fibres, polychemicals, and elastomer chemicals departments. Other products made by E.I. du Pont de Nemours in the US are distributed in the UK by various firms chosen because of their experience or position in a particular field.

Oxone monopersulphate is distributed by Brown and Forth Ltd., 83-117 Euston Road, London NW1, who are the exclusive UK distributors for the products made by the electrochemicals department of E.I. du Pont de Nemours and Co., in Wilmington, Delaware.

★ THE INCREASING need for bulk supplies of chemical reagents which have extremely low limits of impurities, for use in polarography or for trace analysis, has led to the formation of an exploratory committee to investigate the possibilities of preparing the necessary specifications.

The committee is anxious to obtain as much information as possible about the limits to which impurities can be tolerated and the estimated annual consumption of reagents. A special questionnaire can be obtained from the secretary of the committee, Mr. W. J. Parker, 55 Oriental Road, Woking, Surrey.

Represented on the committee are the following organisations: Animal Diseases Research Institute; Association of Public Analysts; DSIR-Interservices Panel for Physico-chemical Methods of Analysis; MRC Department for Research in Industrial Medicine; Photoelectric Spectrometry Group; and the Polarographic Society.

★ RESEARCH into free radicals, which provide a method of studying the mechanism of chemical reactions, could, carried a step further, enable scientists to 'tailor-make' the kind of chemical reactions they want to carry out. Two scientists of Monsanto Chemical Co., US, who hold this belief also think that the importance of their work lies not so much in future applications as in a contribution to general knowledge about what goes on when chemicals react.

They are Dr. R. A. Ruehrwein and Dr. J. W. Edwards of the Dayton Research Laboratory, who were selected by Monsanto to participate in an intensive research programme at the US National Bureau of Standards. The US Department of Defence saw in the free radicals a possible source of great energy (free radicals can be trapped and frozen in solid form at temperatures as low as 4°K).

Their work is chiefly concerned with investigating the principal reactions in the condensed phase of free radicals formed from hydrogen, oxygen, etc. They have demonstrated a conversion of oxygen atoms to ozone as high as 60 per cent, pointing the way to perhaps 100 per cent conversion of oxygen gas. Their work also led to the discovery of an unusual new kind of loose compound or molecular association. Apparently molecular oxygen can be held as a complex with various kinds of solids. When warmed, the oxygen is released. This points to a specific way of enriching hydrogen peroxide and nitrogen oxides.

Free radical chemistry has also great significance for plastics, because free radicals make polymerisation possible.

★ THE MAIN trouble with the Sicilian sulphur industry is its excessive production costs which add up, on the average, to 43,000 to 45,000 lire per ton (£27 approximately), while the price the material fetches is 39,494 lire per ton. Only about 20 per cent of the island's output is produced at less than 35,000 lire per ton. Less than 20 per cent of production is spread over as many as 105 production units.

It seems that the only cheerful factor in the industry is the constant increase in demand for sulphur from Italian chemical manufacturers. Consumption rose from 76,000 tons in 1953-54 to 104,000 tons in 1955-56 and 127,000 tons in 1956-57. Usage should increase greatly when SINCAT's plant in Sicily starts operating. In addition, the Augusta Petrolchimica will consume very large quantities of sulphur.

Production of sulphur in Sicily rose from 147,410 tons in 1955-56 to 151,029 tons in 1956-57, which was just under the 1953-54 total of 151,617 tons. Final figures for 1957-58 are not yet available, but it is known that they are around the 150,000 ton mark.

I now learn that the Sicilian Government has authorised the granting of loans to the sulphur mines so that workers can be paid. This concession will remain in force until 31 October 1958 and loans must be repaid by 30 April next. Individual loans are not to exceed 10,000 lire per ton of sulphur delivered.

Alembic

Overseas News

SEVEN DUTCH CHEMICAL FIRMS SIGN PATENTS AGREEMENT WITH ATOMICS BOARD

SEVEN major chemical firms in Holland have come to an agreement with the country's atomic energy board, the Reactor Centrum Nederland, under which they will pay a specified sum to the undertaking and have certain rights to the use of its research experience and to its advice. Any new findings resulting from a combined effort on the part of company and board will, if patented, be patented by the board, with the company receiving full manufacturing rights. The Reactor Centrum hopes, by this means, to develop its activities, with a particular interest in overseas patents.

The contributing firms will have preference in the granting of licences to manufacture such things as are patented by the board as a result of its own sole investigations.

Of the 50 firms involved in the agreement, seven are chemical companies and the rest metallurgical, heavy industrial, shipping and electrical concerns. The chemical firms are: Koninklijke Zwavelzuurfabrieken v/h Ketjen NV, Amsterdam, sulphuric acid manufacturers; NV Koninklijke Nederlansche Zoutindustrie, Hengelo, salt manufacturers; NV Chemische Fabriek 'Naarden,' Naarden; Koninklijke Nederlandsche Gist- en Spiritusfabriek, NV, Delft, makers of yeast and methylated spirits; W. A. Scholten's Chemische Fabriek NV, Foxhol; Albatros Superfosfaatfabriek NV, Utrecht; and NV Electro Zuur- en Waterstoffabriek, Amsterdam, producers of acids and hydrogens.

Members of the Hanover group, which wants to make a cartel contract valid until 1960, are Hanseatische Acetylen-Gasindustrie GmbH, and Hannogas Hannoversche Acetylengesellschaft mbH, Hanover. The Hamburg company is also a member of the other group, which wants a cartel contract for five years in the first instance, though its operations will be in different areas with each cartel. The other two firms in the Hamburg group are Norddeutsche Acetylen- und Sauerstoffwerke AG, Hamburg, also manufacturers of oxygen, and Ernst Schulz, Bremen.

Danish Government's Aid For New £1 Million Perlon Plant

Output of a Perlon plant to be built and operated by a Danish-German condominium at Silkeborg, Denmark, will be large enough to supply the Danish home market and also export a large proportion of its products. Cost of the new plant will be about Kr.20 million (approx. £1 million), of which Kr.7 million (about £350,000) will be loaned to the companies concerned by the Danish Government. The German partner is the Hamburg firm of Phrix-Werke, who manufacture machines for the production of Perlon.

German Acetylene Producers Want To Set Up Cartels

Two West German groups of acetylene manufacturers have applied to the country's cartel office for permission to start group marketing schemes and to form themselves into corporations with civic rights. The groups involved are Die Vereinigte Acetylen-Werke Hannover GmbH and Die Vereinigten Hanseatischen Acetylen-Werke GmbH, Hamburg.

Canadian Cyanamid Acquire Panelyte Interests

Cyanamid of Canada have purchased the Panelyte Division of the St. Regis Paper Company (Canada) at St. Jean, Quebec. The company has formed a laminated products division to operate the plan. This division will be responsible for the marketing of Formica, as well as Panelyte products.

Nuclear-Metallurgical Plant Formed In Belgium

Two Belgian companies, Metallurgique de Hoboken and the Fabrique Nationale d'Armes de Guerre (FN), have pooled their nuclear interests and have formed a new company, Metallurgie et Méchaniques Nuclearies for nuclear-metallurgical work. The new company will have an initial capital of Fr.100 million.

Metallurgique de Hoboken have had considerable experience in dealing with radium, and have in recent years developed their own processes for producing nuclear-pure uranium and uranium salts. The company is one of the Société Generale group and its alliance with FN is aimed at the production and planning of nuclear fuel elements and complete reactor cones.

French Companies Plan First GR-S Synthetic Rubber Plant

Construction of France's first synthetic GR-S rubber plant is to be undertaken by a group of three companies. The participating companies are Shell-St. Gobain (60 per cent owned by Royal Dutch-Shell), Michelin and Cabot-Texas Butadienne (French subsidiary of Godfrey L. Cabot, Inc., US). The plant will be built at Berre, near Marseilles, and will be sited near the Shell-St. Gobain chemical plant and Cabot (France) carbon black factory. The Shell-Berre oil refinery will provide the raw materials.

Initial output likely has not been revealed. Eventual capacity will be 50,000 tons. The plant is expected to be in production in 1961.

Last autumn Cabot France completed their carbon black factory which is to produce 25,000 tons of carbon black per annum in the first stages of production. Socabu (see CHEMICAL AGE, 19 July, p. 112) will be completing this year a butyl plant at the mouth of the Seine which is planned to have an output of 20,000 tons a year. Socabu are formed by a group of French chemical oil and rubber companies.

BASF To Increase Methanol Output

Badische Anilin und Soda Fabrik are at present producing half of the entire methanol manufactured in West Germany, the company reports. Annual production now stands at well over 10,000 tons, and this figure is expected to rise considerably in the next few months with the opening of an extension to the present plant.

Polythene Output to be Raised by Australia

Imperial Chemical Industries of Australia and New Zealand are to increase output of polythene film by 50 per cent. Extensions to their plant at Deer Park, Victoria, are planned, costing nearly £300,000.

Since the plant came into operation in 1950, capacity at the plant has been raised fourfold. Main source of the greatly increased demand has come from the packaging industry.

Hoechst's New Trevira Plant Starts Up Next Month

The West German firm of Farbwerke Hoechst are to start production of Trevira synthetic fibres at a new Bobingen plant in October. The initial production capacity is to be 300 tons monthly. Hoechst's present production rate for Trevira is 100 tons a month.

Eire Government's Approval of Fertiliser Plant

An allocation of £8 million towards the setting up of a factory for production of ammonium nitrate fertiliser at Shannon Bridge, County Offaly, has been approved in principle by the Republic of Ireland Government. The Ministry of Industry and Commerce has instructed the Irish Chemicals Authority to prepare a suitable scheme for the factory.

HP Polythene Expansion By West German Firm

With the bringing into operation within the next month or so of a Kellogg cracking unit, production by Rheinische Olefinwerke GmbH, of Wesseling, Germany, of high-pressure polythene (Hochdruck-Polyäthylen) will rise from 13,000 tons annually to 35,000 tons.

The company's annual production of epoxide resin (epoxyharzene) is 2,000 tons, following the opening of a new plant earlier this year.

PEOPLE in the news

● MR. GEORGE CAMPBELL, B.Sc., A.R.C.S.T., F.R.I.C., has been appointed general manager of the Chemical and Metallurgical Division of the Plessey Company Ltd. He was previously technical manager and deputy general manager of the company's Towcester plant. A graduate of Glasgow University with first class honours in chemistry and metallurgy, Mr. Campbell joined Plessey in 1945 and became head of laboratories of the Swindon Division and later pilot plant manager at Towcester.

● MR. IAN MACLEOD, M.A.S.M.E., A.M.I.P.E., has been appointed technical director of Stockdale Engineering Ltd., Pownton, Cheshire. In 20 years' experience in chemical engineering, Mr. MacLeod has been responsible for the design and production of colloid mills and mixing equipment in Britain, the US, Spain and other parts of the world. At Stockdales, he is to develop their new range of agitation equipment.

Ian MacLeod

D. C. M. Salt

● MR. D. C. M. SALT has been appointed by Monsanto Chemicals Ltd. to the newly-created post of general manager in charge of Chemicals Division. MR. G. DODD is the new general manager in charge of Plastics and Special Products Division. MR. J. V. HEAD is appointed acting controller of purchases in succession to Mr. Dodd.

● MR. I. L. S. GOLDING, who was recently appointed manager of the newly-formed Gas Atmospheres Division of the Incandescent Heat Co. Ltd., Smethwick, has had wide experience in the chemical and chemical engineering fields. He was associated with a large consulting organisation for a number of years, until he joined the Incandescent Group early in 1953 as chief chemist of one of the subsidiary companies. In 1955 he took over chemical engineering development within the group and was associated with the development of several new types of gas generator and processing equipment.

● MR. JOHN TOWERS, managing director of J. W. Towers and Co., Ltd., of Widnes, and 11 of his company's sales and production executives were recently the guests of Quickfit and Quartz Ltd., at Stone, Staffs.

● MR. G. F. REYNOLDS, M.Sc., F.R.I.C., principal scientific officer, Chemical Inspectorate, Ministry of Supply, has accepted the chairmanship of the technical advisory panel of the British Polarographic Research Institute. The panel consists of specialists in various branches of polarography, all of whom have offered their services in an honorary capacity. MR. W. J. PARKER, B.Sc., A.R.I.C., A.M.Inst.F., A.M.Inst.Gas E., secretary of the British Polarographic Research Institute, has resigned his appointment with Mervyn Instruments to devote more time to the development of the Institute. He will continue to act as polarographic consultant to the company.

● MR. W. L. BAKER, manager of the Metal Finishing Division of the Pyrene Co. Ltd., Brentford, Middx, retired on 1 September after 30 years' service with the company. He is succeeded by MR. H. A. HOLDEN, M.Sc., A.R.C.S., D.I.C., A.I.M., who has had many years' experience in the division. MR. H. F. PARSHALL, T.D., M.A., who has been with the company for some 20 years, continues as director in charge of the division.

● MR. G. B. TAYLOR has been appointed sales manager (works division) and Mr. R. H. Foster, A.M.I.C.E., works manager of Ashmore, Benson, Pease and Co., Stockton-on-Tees, a member of the Power-Gas Group.

● DR. P. L. PRATT, Ph.D. (Cantab), lecturer in physical metallurgy at Birmingham University, has been appointed to the London University readership in physical metallurgy, tenable at the Imperial College.

● The General Chemical and Pharmaceutical Co. Ltd., have elected MR. J. E. WHITE, office manager, and MR. N. F. WHITHOUSE, export manager, to the board. Both have been with the firm for many years.

● Owing to ill-health, MR. W. A. WALMSLEY has retired as joint managing director of Thomas Ness Ltd., tar distillers, and chemical manufacturers, Consett, Co. Durham. He retains his directorship of the company. A graduate of Manchester University, Mr. Walmsley received his early training with the West Cumberland By-Products Co. Ltd., Flimby. He was president of the Association of Tar Distillers in 1947-9. Mr. Walmsley's successor as joint managing director is MR. E. A. BOWER, a director of Thomas Ness since 1929.

● MR. P. S. NEEDHAM has been appointed joint managing director of Genatosan, a subsidiary of Fisons. Mr. Needham was previously with Joseph Sankey and Sons.

● DR. D. G. BROWN, research librarian for the last 15 years with the ICI Nobel Division, retired on 29 August. During his 33 years with the company he had been analyst in charge of the division's laboratories at Dalbeattie.

Foster Wheeler to Build Milford Haven Refinery

ESSO PETROLEUM LTD., affiliate of Standard Oil (NJ) have signed a contract with Foster Wheeler Ltd. for the construction of a 100,000 BPSD 'grass roots' refinery at the deep water port of Milford Haven, Wales. The new refinery, with the Esso refinery at Fawley (also built by Foster Wheeler and currently being expanded to 220,000 BPSD) is said to be capable of supplying about 37 per cent of Britain's petroleum needs.

Process units include a 100,000 BPSD atmospheric distillation unit including naphtha splitter and stabiliser; a 16,500 BPSD blocked operation powerformer; a 16,500 BPSD gas oil hydrofiner; a 31,500 BPSD gas oil drying unit (electric coalescer); and copper chloride sweetening facilities.

Allen & Hanbury—Irani Agreement Signed

Signing a £1 million contract with Allen and Hanburys for the building in Iran of a pharmaceuticals factory is His Excellency Dr. D. Ashtiany, managing director of Darou Pakhsh and of the Irani Royal Society for Social Services. With him is Mr. C. W. Maplethorpe, managing director of Allen and Hanburys Ltd. **(see p. 398)**

Silicates on site

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Commercial News

- **Courtauld's Subsidiary Acquires Cellon**
- **Unilever Half-year Turnover Up by £14 m.**
- **Murex May Close Zirconium Pilot Plant**
- **Israeli Fertiliser Plants Plan Expansion**

Group Developments

Courtauld's subsidiary, Group Developments Ltd., have announced that in response to the offer made on their behalf to purchase the ordinary shares of Cellon at 20s per share, holders of over 90 per cent of the shares have accepted and accordingly the offer has become unconditional.

Unilever Ltd.

A £14 million increase in the consolidated turnover of Unilever Ltd., and Unilever NV for the half year to 30 June 1958, is noted, compared with the corresponding period in 1957. The combined total was £860 million. However this total shows a fall of £14 million compared with the six months ended 31 December 1957.

Combined profits for the 1958 period were £43.2 million (£43.7 million a year ago and £41.6 million for the December half year). After tax, the profit balance was £20.9 million against £20.6 million and £19.6 million respectively.

Murex Ltd.

In spite of cuts in the defence programme and weakness in the wolfram market, Murex Ltd., have made a substantial profit, reports Sir Arthur Smart, in his annual review. Group profits before tax were £723,220 (£798,246) for the year to 30 April. Dividend has been cut from 20 per cent to 17½ per cent.

The Murex pilot plant for zirconium was designed to produce sponge metal by a small batch process from zirconium tetrachloride. Production costs are reported by Sir Arthur as being high in comparison with those of the US, where producers have had the advantage of Government financial assistance to build large scale fully integrated plants. Murex's contract with UK AEA will expire this autumn and commercial usage is likely to be slow in developing. On expiration of the UK AEA contract, it is probable that the pilot plant will cease production. The company has gained, however, considerable technical knowledge which can be utilised in other fields.

An encouraging increase in the demand for tantalum is noted. The pilot plant has been expanded to keep pace with demand and work has started on the erection of a new plant for tantalum and niobium powders. This plant should come into operation next year. Plans for increased production of fabricated tantalum products are in hand. At the request of the AEA, the agreement for the management of the agency factory at Milford Haven for the production of beryllia and beryllium has been extended for a further four years.

There has been a marked falling off in authorisations for capital expenditure by the Murex group as the expansion programme is nearing completion. Expenditure during 1957/58 was £590,000, compared with £520,000 during the previous year and £310,000 in 1955/56. Over the past two years, therefore, over £1 million has been spent on capital projects, almost entirely at Rainham. The new molybdic oxide plant is now in operation.

Last December, Treasury consent was obtained to raise not more than £1.3 million by the issue of unsecured loan stock and to bank borrowings not exceeding £500,000 over the six months to 1 December 1958. No action with respect to this issue was anticipated before the autumn of this year. It is expected that the current year's outlay will be met substantially from present resources and banking facilities.

Federation Chemicals Ltd.

The US Government has agreed to guarantee W. R. Grace and Co., that they can convert into dollars up to $17.75 million of their investment in Federation Chemicals Ltd. (See CHEMICAL AGE, 16 August, 269.)

Israeli State Industries

Reports from Israel indicate that all except one of the State-owned producing companies have plans for further expansion of production. Fertilisers and Chemicals, Haifa, the second largest company, increased output in 1957-58 to 303,000 tons, an increase of nearly 25 per cent over the previous financial year.

Output of potash at the Dead Sea Works at Sodom was raised to 86,000 tons in 1957-58, from 50,000 in 1956-57. In September new installations are due to go into operation, which are expected to bring production in 1958-59 up to 120,000 tons. A further increase, to about 15,000 tons, is anticipated for 1959-60.

In the financial year 1957-58, the Negev Phosphate Co. produced 186,000 tons of phosphate compared with £114,000 in 1956-57. At the Oron phosphate works a flotation installation is under construction and additional equipment has been acquired so that 250,000 tons of phosphate annually can be produced.

The potash and phosphate companies are expected to show a net profit in 1958-59 when full capacity production is due to be reached.

INCREASES OF CAPITAL

GEORGE H. ANDERTON LTD., agricultural and manufacturing chemists, etc., Ouse Chemical Works, Howden, Goole. Increased by £120,000 beyond the registered capital of £120,000.

CROOKES LABORATORIES LTD., Gorst Road, Park Royal, London NW10, increased by £250,000 beyond the registered capital of £250,000.

LAPORTE INDUSTRIES LTD., 14 Hanover Square, W1, increased by £6,000,000 in 7,174,239 ordinary shares of 10s and 9,651,522 ordinary shares of 5s each, beyond the registered capital of £6,000,000.

MIDLAND AEROSOLS LTD., preparers of aerosols packages, etc., Dominion Works, Gt. Brickkiln Street, Wolverhampton, increased by £40,000 beyond the registered capital of £20,000.

Market Reports

NEW DEMAND COVERS WIDER FIELD

LONDON Price conditions are unchanged and the undertone steady in virtually all sections of the industrial chemicals market. New demand on home account, although limited to nearby requirements, has covered a wider field than of late and the chief industrial outlets are calling for good quantities against contracts. The flow of export inquiry has been maintained at a good level and the supply position generally presents little difficulty. A steady demand for both crude and refined tar has been reported.

MANCHESTER Sellers on the Manchester chemical market have again reported a slight improvement in the weight of new home business, though in a number of instances buyers are less inclined than normally to venture far ahead. Existing commitments are being drawn against reasonably well on the whole. On the export side, there has been a falling off in the demand for caustic soda and several other bread-and-butter lines. Prices generally have been well maintained. There is fair activity in some sections of the fertiliser trade.

GLASGOW The activity previously reported has continued during the past week in the Scottish heavy chemical market, and a good week's trading has been experienced. Current requirements have been well to the forefront, and demands have been for a varied cross section of heavy chemicals. Some variation in prices occurred but on the whole the tendency was to firmness.

The position has been much quieter in regard to agricultural chemicals.

TRADE NOTES

New 'Styrenated' Alkyd

Styrene Co-Polymers Ltd., 1 Roebuck Lane, Sale, Ches, announce the bulk production of SCOPOL 55NM, a quick air-drying 'styrenated' alkyd. Principal feature of this new resin is its availability in white spirits solution, to which it is said to be infinitely tolerant.

Change of Address

Address of Petrocarbon Developments is now 76 Jermyn Street, London SW1 (Whitehall 8411). The design and development offices remain at Sunlight House, Quay Street, Manchester 3.

Reconditioned Jerricans

The Jerrican Division of J. E. Lesser and Sons Ltd., Green Lane, Hounslow, Middx, state that the recently opened works of their associate company, Circle Works (Blaby) Ltd., at Verwood, Dorset, is now fully operating. Large stocks of reconditioned jerricans, mainly of post-1952 manufacture, are held at Verwood.

Hydronyl Amalgamation

The Hydronyl Syndicate Ltd., and Weinreb and Randall Ltd., have amalgamated under the title of the former company, and Mr. D. G. Randall, B.Sc.(Eng), M.I.Chem.E., A.F.Inst.Pet., has been appointed technical director. Dr. R. Lessing, C.B.E., Ph.D., F.R.I.C., continues as managing director and Mr. W. J. Browning, M.Inst.F., as commercial director. The reorganisation is planned to enlarge the scope of the joint activities, largely concerned with tower packings.

Sebacic Acid Price Cut

Manufacturers of sebacic acid in this country for the past 10 years who have recently extended their plant at Trafford Park, the Geigy Co. Ltd. have now reduced the price of sebacic acid. The reduction, effective 1 September, amounts to 4d per lb., and it lowers the list price of sebacic acid from 6s 2d to 5s 10d per lb.

At the same time Geigy are reducing the prices of diester and polyester plasticisers manufactured from sebacic acid. Reductions on the Reomol sebacate diester plasticisers vary from 2d to 2½d per lb., and those on the Reoplex polyester plasticisers from ¼d to 2½d per lb.

Changes of Name

Safca Aerosol Company Ltd., Sardinia House, 52 Lincolns Inn Fields, WC2 to S.A. Realisation Company Ltd.

Hy. Richardson and Co. (York) Ltd., Ouse Chemical Works, Howden, Goole, Yorks, to Anderton-Richardson Fertilisers Ltd.

New High Purity Butene Concentrates Available

TWO NEW petrochemical materials—high purity butene-2 and butene-1 concentrate, previously available mainly as mixed isomers, are now being offered commercially by the Texas Butadiene and Chemical Corporation, who state that these grades of n-butylene isomers have not yet been produced in Europe for tonnage deliveries.

Dr. Alexander R. Marx of 29 Rue Cambon, Paris 1, the company's European representative, states that a feed for butadiene and sec-butanol containing a single normal isomer would overcome problems caused by a mixed feedstock and possibly open up new avenues of approach to butylene chemistry.

Two grades, 60 per cent butene-1 and 96 per cent butene-2, are now available in bulk; quantities of 90 per cent butene-1 will be available later this year.

MoS Chemical Inspectorate Moves to Woolwich

The Chemical Inspectorate of the Ministry of Supply has moved from Kidbrooke to Headquarters Building, Royal Arsenal, Woolwich, London SE18—tel. Woolwich 4261. The information and library services of the inspectorate, however, are to remain at Kidbrooke for the time being.

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NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 8 October

Recovering glutamic acid values from a fermentation residue. International Minerals & Chemical Corp. **802 560**

Method of desulphurising hydrocarbon oil. Standard Oil Co. **802 609**

Lignin-reinforced rubber. United States Rubber Co. **802 611**

Difficult hydrolyzable additives for diesel fuels. Badische Anilin- & Soda-Fabrik AG. **802 612**

Organopolysiloxanes. Midland Silicones Ltd. **802 467**

Open flame curing of diolefin polymer oils. Esso Research & Engineering Co. **802 562**

Manufacture of manganese zinc ferrites. Standard Telephones & Cables Ltd. (Nippon Electric Co. Ltd.). **802 613**

Oxidised polymer oil latex. Esso Research & Engineering Co. **802 563**

Preparing glycols and monoethers of glycols. Dow Chemical Co. **802 778**

Making a nonporous, semicrystalline ceramic body. Corning Glass Works. **802 564**

Ferrous sulphate-glycine complex. Schwarz Arzneimittelfabrik GmbH. **802 565**

Cellulose ethers. Mo Och Domsjö Aktiebolag. **802 469**

Preparation of a motor gasoline with an octane number of at least 95. De Bataafsche Petroleum Maatschappij N.V. **802 793**

Steroid and the manufacture thereof. Upjohn Co. **802 566, 802 618**

Production of acetylenic diols. Dow Chemical Co. **802 794**

Production of phenylhydroxylamine. Institut Francais du Petrole Des Carburants et Lubrifiants. **802 619**

Method of preparing hydrocarbon-tin compounds. Kali-Chemie AG. **802 796**

Production of N-(2-pyrimidyl sulphenyl)-morpholines. Chemische Werke Hüls. **802 622**

Production of beryllium. UK Atomic Energy Authority. [Addition to 781 100.] **802 470**

1-Ethinyl-cyclohexyloxyalkahols. Dow Chemical Co. **802 798**

Phenthiazine derivative and process for its preparation. Soc. Des Usines Chimiques Rhone-Poulenc. [Divided out of 802 725.] **802 726**

Open to public inspection 15 October

Electrolytic cells for the production of aluminium. British Aluminium Co., Ltd. **802 905**

Preparation of natural rubbers. British Rubber Producers Research Assoc. **803 013**

Ternary alloys of uranium, columbium and zirconium. Foote, F. G. **803 118**

Compositions for improving the soil. Dow Chemical Co. **803 052**

Transparent polyester resin-bonded glass fibre material. Robertson Thain Ltd. (Robertson Co., H. H.) **803 014**

Bis-*P*-aminophenoxy compounds of pharmaceutical value. Wellcome Foundation, Ltd. **803 072**

Textile yarns and methods of thermally processing them. Seem, W. A., Stoddard, N. J., Tecce, F., and Berger, H. P. [trading as Permatwist Co.] **803 105**

Thermo-plastic yarns and methods of processing them. Seem, W. A., Stoddard, N. J., Tecce, F., and Berger, H. P. [trading as Permatwist Co]. **803 107**

Stabilisation of halogen-containng synthetic resins with organic phosphites. Carlisle Chemical Works, Inc. **803 081**

Flexible resilient cellular resin products. Lockheed Aircraft Corp. **802 868**

Salts of substituted 2-imidazolines. Mannheimer, H. S., and McCabe, J. J. **803 019**

Increasing the bulk density and the degree of aggregation of extremely finely divided inorganic substances. Flemmert, G. L. **802 953**

Basically substituted heterocyclic compounds and process for their manufacture. Ciba Ltd. **802 901, 802 902**

Apparatus for effecting distribution of a solute between two liquid phases. Gibson, A. R., and Wright, A. G. **802 954**

Cemented carbide compositions. General Electric Co. **802 801**

Sintered carbide compositions. General Electric Co. **802 802**

Polymethacrolein reaction product. General Tire & Rubber Co. **803 053**

Preparation of keto acids. Polak & Schwarz's Essence-Fabriken N.V. **803 120**

Diquaternary compounds, manufacture thereof. Wellcome Foundation, Ltd. **802 870**

Treatment of polyethylene terephthalate surfaces. Imperial Chemical Industries, Ltd. **802 974**

Filter presses. Associated Portland Cement Manufacturers, Ltd., Bishop, L. H., and Foster, J. W. **802 911**

Continuous textile bleaching process. Imperial Chemical Industries, Ltd. **803 021**

Method and plant for manufacturing pig iron in a blast furnace. Soc. des Acieries de Pompey. **803 002**

Plastic structures comprising polyethylene terephthalate. Imperial Chemical Industries Ltd. **802 975**

Manufacture of hydrogen peroxide. Laporte Chemicals, Ltd. **803 121**

Treatment of boiler feedwater. Imperial Chemical Industries, Ltd. **802 875**

Installations in dispensing under pressure measured quantities of volatile liquids from a bulk supply. Officine Botto Meccanica de Precisione, Soc. R.L. **802 917**

Anodes for use in the production of aluminium. Pechiney Compagnie de Produits Chimiques et Electrometallurgiques. **803 085**

Polymethylene terephthalates. Imperial Chemical Industries, Ltd. **802 921**

Electrolysis of fused salt. Montecatini Soc. Generale per L'Industria Mineraria e Chimica and Varda G. de **802 959**

Sulphur burning. Kimberly-Clark Corp. **802 984**

Chromium coordination complexes. Minnesota Mining & Manufacturing Co. **802 962**

Starch product. American Tansul Co. **803 123**

Process for bonding articles. Deutsche Gold- und Siber Scheideanstalt Vorm. Roessler. **803 054**

Process for rendering textiles water-repellent. Midland Silicones, Ltd. **803 055**

Plant for a gaseous reaction process. Spalding, D. B. **803 026**

Methods for producing fertilisers and product thereof. Lummus Co. **802 829**

Treatment of sulphur. Stauffer Chemical Co. **802 964**

Anthraquinone dyestuffs. Imperial Chemical Industries, Ltd. **802 935**

Cooling of nuclear reactors. Union Carbide Corp. **802 938**

Method of and compositions for treating concentrated acids to prevent corrosion of metals in contact therewith. Bernard, M. L. J. **802 894**

Manufacture of tubes of plastic material, and more particularly of polyamides. Compagnie Francaise des Metaux. **802 939**

Manufacture of derivatives of 4-hydroxy-isophthalic acid. Erlenmeyer, H. **802 841**

Method and apparatus for forming fibres. Owens-Corning Fiberglas Corp. **803 126**

Lubricating composition. Esso Research & Engineering Co. **802 941**

Production of alloy single crystals and semiconductor arrangements produced by such processes. Siemens & Halske A.G. **802 842**

Polymers. Du Pont de Nemours & Co., E. I. **802 843**

Treatment of copper. Bolidens Gruvaktiebolag. **803 102**

Lubricating grease compositions. Bataafsche Petroleum Maatschappij N.V., De. **802 896**

Siloxanes. Midland Silicones, Ltd. **803 129**

Process for recovering hydrazine. Grace & Co., W. R. **802 846**

Carotenoid preparations suitable for colouring foodstuffs and animal feeds and a process for the manufacture thereof. Hoffmann-La Roche & Co. A.G., F. **803 077**

Dyed resinous pigments. Switzer Bros., Inc. **803 057**

Oral fat emulsions. Schenley Laboratories, Inc. **803 078**

Heat-exchangers for condensing constituents from a gas mixture. Philips Gloeilampenfabrieken N.V. **803 040**

2, 2, 3, 3-Tetrachloro-1, 4-butanediol. General Aniline & Film Corp. **803 058**

Butadiene. Chemische Werke Hüls A.G. **803 042**

2-Methyl-1-2-see-butyl-1, 3-propanediol dicarbamate. Carter Products, Inc. **803 059**

Preparation of organosilicon compounds. Midland Silicones, Ltd. **802 969**

Process for purifying fluids containing carbonyl sulphide as impurity. Bataafsche Petroleum Maatschappij N.V. de **803 043**

Manufacture of 4-aminoisoxazolidone-(3) and derivatives thereof and said derivatives. Hoffmann-La Roche & Co. A.G., F. **802 946**

Preparation of phenothiazine derivatives. Sandoz, Ltd. **802 947**

Production of lactic acid and derivatives. Escambia Chemical Corp. **803 060**

Preparation of high molecular weight synthetic linear polyamides. Du Pont de Nemours & Co., E. I. **802 970**

Reduction of iron ores. Titan Co., A.S. **803 008**

Polymerisable compositions and their production of polymer products therefrom. Du Pont de Nemours & Co., E. I. **802 853**

Fatty acid amides and derivatives thereof. American Home Products Corp. **802 995**

Substituted propanediol dicarbamates and their preparation. Carter Products, Inc. **802 978**

Preparation of 2-substituted-1, 3-propanediol dicarbamates. Carter Products, Inc. **802 979**

Process of dyeing acrylonitrile polymer and copolymer textile articles. Etablissements Schaeffer & Cie. **803 095**

Process for the destruction of radioactive residues. Verschraeghen, L. **802 971**

Preparation of 3, 4-dimethyl-5-sulphanilamido-isoxazole. Istituto de Angeli Soc. per Azioni. **803 062**

Metal-ceramic compositions. Morgan Crucible Co., Ltd. **803 079**

Mercurihydroxypropyl derivatives of theobromine and process for preparing same. Lakeside Laboratories, Inc. **802 881**

Avonmouth Gas-from-Oil Plant Planned

PURE non-toxic gas from oil by-products will be produced at a new plant to be set up at Avonmouth, Bristol, by the South-Western Regional Board for industry. Capacity of the plant will be over 5 million cubic feet a day. Cost of building the high-pressure gasification plant which is still in the design stage, is estimated at under £1 million or about half the cost of normal plant.

The plant will be designed to use 'primary flash distillate.' The resulting gas would be free of sulphur and virtually free of carbon monoxide.

Announcing this news, Mr. C. H. Chester, chairman of the SWGB, said that it was expected that work on the plant would start next year. He also reported that the first cargo of liquid methane gas might reach the UK by the end of this year.

Desulphurising Process

Correct title of the fluidised desulphurising plant developed in the Frodingham research department of the Appleby-Frodingham Steel Co., Scunthorpe, Lincs, and the subject of our leading article on 9 August, is the 'Frodingham desulphurising process'.